BEAUTIFYING INDIA

By the Same Author

THE ART OF E. H. BREWSTER AND ACHSAH BREWSTER (1944)

DEVELOPING VILLAGE INDIA : STUDIES IN VILLAGE PROBLEMS (1946)

SUSHIL SARKAR'S PAINTINGS (1947)

Awakening Asoka flowers

M. S. RANDHAWA

BEAUTIFYING INDIA

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TO

JAWAHARLAL NEHRU

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M. S. RANDHAWA

CHAPTER 1

Beautifying India

BEAUTIFYING India! Is not India beautiful, you will ask. India the land of the Himalayas, the Ganges, and sunshine. Yes, that is one side of the picture, and in our patriotic zeal, we are apt to forget the dust, disease, flies, ugliness, disorder and the hungry millions. While we are making plans for increasing the agricultural and industrial wealth of the country, we should not ignore the problem of making the country beautiful. While we are planning to banish poverty by harnessing the man-power and material resources of the country with the aid of science and machine we should also have plans for banishing ugliness of the landscape by planned planting of beautiful flowering trees. We are on the threshold of the Age of Plenty, and let us enter the Promised Land with a lily in our hands.

"How do you propose to set about the task?" you will ask. "How will you beautify such a vast country as ours?" The problem is stupendous, gigantic, a challenge to our resourcefulness. And yet it is simple. If I am successful in kindling consciousness of beauty in some of my countrymen, particularly in those who occupy places of power and can get things done, I shall be satisfied that these lines were not written in vain.

We are living in the period of Indian Renaissance. An amorphous mass of humanity is taking shape, and though education is limited to a small percentage of the entire populace, we have already produced scientists, writers and painters

who have made valuable contribution to world culture and progress. When the sieve of mass education starts sifting talent, and opportunities are provided to young men and women from the villages of India to develop their personalities, the contribution of India to Science and Arts will be more substantial. When the stresses and strains of partition are relieved, and multipurpose hydro-electric schemes are implemented, this country will enter a period of economic affluence, and an intelligent leisure class will emerge. It is in such times of regeneration that art and science appear in a nation. For healthy and balanced development of a nation, wealth in the form of material goods is, no doubt, necessary, but a beautiful environment is just as essential. Colourful trees and flowers play a great part in making the environment beautiful and refining the minds of the inhabitants. Here is a plan for planting flowering trees on a mass scale in inhabited areas of this country. That is how we can beautify India.

A Bioaesthetic Plan

We are indebted to Professor Lancelot Hogben for the term "Bioaesthetic planning" which may be defined as conscious planning of the flora and fauna with the object of beautifying the country. Bioaesthetic planning embraces both the animal and plant sciences, Botany and Zoology, and may be further defined as planned ecology of living beings from the artistic and aesthetic point of view. It includes the plantation of ornamental flowering trees along city roads, in parks, public places and compounds of houses both in towns and villages, and development of national parks for the preservation of beautiful, non-carnivorous animals, and the creation of bird sanctuaries. The object of a bioaesthetic plan for India is the encouragement of plantation of selected ornamental flowering trees in our towns and villages, protection of beautiful, harmless birds like wild ducks, egrets, geese and sarus cranes by legal declaration of our big *Jheels* as bird sanctuaries, and preservation of graceful animals, which are being ruthlessly exterminated such as black buck, blue bulls, sambhars and spotted deer in national pars and zoological gardens in the vicinity of our big towns.

Bioaesthetic Planning and Landscape Gardening

Bioaesthetic planning of course, embraces landscape gardening as well, but it is a much wider term. The whole country is susceptible of bioaesthetic planning, provided a consistent policy is followed and a persistent effort made over a long period. The bioaesthetic planner is a master artist whose canvas is the entire country and his pigments are the beautiful flowering trees. He paints the canvas of the countryside in rich colours, blue, yellow, orange, scarlet, red and pink. The blue Jacarandas, yellow Amaltas, orange-scarlet Gul Mohurs, scarlet Colvilleas, red Erythrinas and pink Lagerstroemias are with what he paints the side-walks of roads, the platforms of railway stations, the canal-banks, and compounds of houses and public buildings. His objective is to lay them out in a pleasing pattern, so that an attractive picture results.

Planning *Vs.* Laissez-faire

With the success of the Soviet Five-Year Plans, planning has become the rage of our epoch. All thinking people realize the danger and wastefulness of 'Go-as-you-please' and 'Devil-take-the-hindmost' competitive unplanned economy which we have inherited. All over the world, people have begun thinking of the future needs of the community and have realized the value of planning. Whatever views people may have about the virtues or vices of a communistic society, all concede the greatness of the planning idea which may be regarded as the major contribution of the Soviet Union to world civilisation. The idea of planning appeals to the imagination of the thinking people who appreciate clear thinking, for it is scientific. It is also the quickest method of developing the resources of a backward country and hence its appeal to the people of China and India. The idea of planning is not novel to the biologist who deals with the classification of plants and animals, and their orderly arrangement in phyla, classes, families, genera and species, thus creating order out of chaos. In fact Carl Linnaeus was a very great planner indeed, for he cleared so much confusion and created an orderly Biology.

Bioaesthetic planning is the projection of the systematising and planning mentality of the biologist into the field of every-day life. The planning of our cultural and aesthetic life is a necessary concomitant of the planning of our social and economic life. While we are planning our industries and agriculture we can hardly ignore the environment of the human beings.

Though a beautiful pattern may result by chance out of haphazard efforts of individuals it cannot be called planning for beauty. Planning has been described by Professor Abercrombie as "a conscious exercise of the powers of combination and design, and not a question of unconcerned growth, even though the latter may produce fortuitously happy results."

Bioaesthetic Planning *Vs.* Wild Nature

About 150 years ago in Europe and about fifty years ago in this country, the common man was afraid of wild country, mountains, lakes and forests. Mountains and forests were regarded with a feeling of horror. It is only in the nineteenth century that educated people began to admire beauty of the mountains and forests. In India the educated classes are under a heavy debt to Wordsworth for inculcating the love of nature. Since then the pendulum has swung to the other extreme. There is in some of us an undiscriminating and irrational adoration of nature. People who have never grown a herbaceous border of annual flowers in their own house, burst out in panegyrics on seeing a clump of anemones or potentillas in the hills. It is far from my intention to decry the beauty of alpine flowers in the Himalayan meadows as compared with the annual flowering plants in our gardens in the plains. On the other hand, I hold that in the magnificent setting of the Himalayan snows a planned alpine garden will look much better than anything nature has ever produced. Untamed

nature is disorderly, chaotic and wayward. Man has been constantly fighting his environment. He battles with nature to produce a semblance of order. He clears the jungles, breaks virgin soil for cultivation, diverts the courses of rivers, makes canals and embankments for irrigation, and converts waste-land into parks and gardens. While in some cases he has produced ugliness by his haphazard, uncontrolled, and misdirected actions, in other cases he has been able to improve upon nature. Who can deny the beauty of the poplar-lined roads of France, the vine-yards of the Rhine, the tulip-fields of Holland, the saffron-terraces of Kashmir, and the hedge-rows of the English countryside? Those who admire the beauty of the English countryside forget that it is the result of the hard work of many generations. Describing the evolution of the English countyside, Lancelot Hogben writes, "What generally gains admiration for the beauties of the English countryside is not nature as such. Untouched nature is generally monotonous. English parklands, hedgerows, and many of our woodlands are the result of human interference, sometimes by the deliberate action of enthusiastic pioneers of bioaesthetic planning, like John Evelyn, and sometimes as relics of past cultivation." Similarly the wonderful landscape gardens of Japan are the result of toil of generations.

However, broadly speaking, man's battle with nature and environment has been haphazard and there has been no conscious planning and direction of his efforts. The explanation is simple. Individuals who set about consciously changing and planning their environment are rare. On the other hand the large majority of people are content with their mode of living and their everyday environment. Moreover, it is by a rare chance that the odd individuals who change things are in a position of power where they can execute their plans. This is more true of India as compared with other countries. Excepting the Moghuls who came from the arid region of Central Asia and were more garden-conscious than Indians, and left behind wonderful terraced gardens and planted grand avenues of Chenar (*Platanus orientalis*) along the banks of the Jhelum in Kashmir, our country has been practically untouched, so far as bioaesthetic planning is concerned. May be, our comparative neglect of gardening is due to the luxuriant jungle vegetation which surrounds our villages. But, now, this should be a help rather than hindrance in planned planting of flowering trees.

Town Planning and Bioaesthetic Planning

Town planning and bioaesthetic planning should go hand in hand. Orderly and planned planting of ornamental trees can be seen to its best effect in new towns with wide roads, flanked with shady foot-paths, well-laid-out public parks and squares, rather than in congested old towns with narrow crooked streets. Our old towns offer little scope for bioaesthetic planting. Firstly, they contain no open places suitable for plantation and secondly, their streets and roads are too narrow. Planting of flowering trees in an old town appears like draping an old, haggard

and ugly woman in a brilliantly coloured new sari, which merely throws her ugliness into greater contrast. Beautiful new clothes are displayed to their best advantage on a good-looking young woman and bioaesthetic planting too can be seen at its best in new residential quarters which are growing up in the outskirts of old towns.

Our Old Towns

Town-planning is a precondition of bioaesthetic planting. We have allowed our towns to develop without any plan or order, like mushrooms on a dung-heap. In our country *laissez-faire* has really run amuck and the results have been most unfortunate. Ugly ill-ventilated houses joined together in monstrous piles along narrow crooked lanes—that is how our ancient towns like Amritsar, Lucknow and Banaras appear to an outsider whose eyes are accustomed to western orderliness. An aerial view reveals them as pieces of a jig-saw puzzle, mixed up in a crazy pile. And not a patch of green in these prison-like piles of masonary! These houses may have been suitable in insecure times of the middle ages when security rather than ventilation was the guiding principle in our domestic architecture, but in the present social contest they appear anachronisms and fossils of a social and economic order which disappeared long ago. In these old towns, we see a reflection of our disorderly and indisciplined social and economic life. They may appear romantic to foreigners who come to our country in search of oriental mysticism and magic, but are certainly unfit for the growth of a healthy nation. It is time that we realise that we have had enough of these stinking streets. The younger generation must be educated in a new mode of living. We must improve the environment in our towns.

Improving Old Towns

A very pertinent question arises about the future of these old towns. What should be done with these ancient insanitary slums? Some would recommend wholesale demolition. But that is an extreme view, idealistic rather than practical. We should try to improve them as far as practicable. These old towns are in need of drastic surgery. We must decongest old residential areas by compulsory acquisition of suitable central housing areas, and after demolishing the ugly houses thus acquired, we should develop parks and open spaces in the sites thus vacated. Improvement Trusts have done useful work in Kanpur, Lucknow and Delhi but the pace of progress is snail-like, and painfully slow considering the rapid urbanization and alarming increase in the population of our cities. In the parks thus made swimming pools should be constructed for the recreation of citizens in hot weather and incidentally for irrigating the trees and lawns.

As regards the growth and expansion of our towns, control and planning are very essential. All available land in a radius of three miles or more from the inhabited area according to future needs should be compulsorily acquired by the municipalities and planned into residential areas with sizeable plots for

houses and wide roads. The garden suburb should be our ideal in this warm country, for vertical development is unsuitable considering the summer heat ; and flats are positively uncomfortable in summer. Moreover the development of motor transport has greatly facilitated horizontal and peripheral development of towns. As far as possible the growth of these garden suburbia should be planned in a concentric manner, as this will mean economy in fuel consumption for motor vehicles.

With the planned development of our old towns as outlined above a good deal of improvement is possible. It will not only provide suitable houses for the man of moderate means, but will also provide a check on the unbridled anti-social activities of the site-gamblers, rack-renters, and slum-builders. It is very essential that the Government calls a halt to the process of slummification so that the activities of chawl-builders who are creating problems for the future are curbed, and the colossal waste of wealth of the country on rows of ugly houses is stopped. With evisceration of slummy quarters, development of parks and tanks in decongested areas, and controlled development in the suburban areas we can make our old towns also fairly attractive.

New Towns

Towns develop along the lines of communications and serve as producing or distributing centres. Our old towns developed along the banks of rivers which were the main channels of communication in the past and served as distributing centres where the villagers exchanged their agricultural produce for hand-made articles manufactured by the artisans of towns. Under the stress of modern industrial development, with machine production and rapid communication by means of railways and motor vehicles, the old distributing town along the river bank is an anachronism. New manufacturing towns will arise in course of time near the source of raw materials, though not to the same extent as in young developing countries like the United States of America and the Soviet Union. Like their Pittsburgh, Detroit, Magnitogorsk, we too will have big manufacturing centres in course of time and Jamshedpore of Tatas is a case in instance. With the development of hydro-electic projects industry is bound to spread, but more in the vicinity of existing towns rather than in new sites.

The Garden City

So the problem arises : what should be our ideal in this new town development? The Garden City should be our ideal and the Welwyn Garden City in England and the Model Town of Lahore provide examples which may be profitably followed in the development of new population centres.

The noisy clanking tram-car with its ugly rails spoiling the streets should be definitely banned in these new towns. With electrification which will come in the wake of hydro-electric schemes, trolley-buses will be most suitable for transporting people to their places of work from their homes in garden

suburbs. For our city of the future, Le Corbusier model with many-storeyed offices and factories linked with the garden suburbs by means of bioaesthetically planted roads will be very suitable. People will work in the production hub of the city during day-time and will disperse again in the garden suburbs in the evening enjoying life in healthy, quiet, noise-free and dust and smoke-free surroundings.

Swimming Pools

Swimming pools should form an essential feature of these new towns. People can enjoy themselves in these tanks during summer and the used water can irrigate the public parks and gardens, which should be planted with ornamental flowering trees. Canals, where available, can also serve a useful purpose and provide excellent opportunities for scenic planting and beautifying the towns.

CHAPTER 2

Appreciation of Beauty

THE teachers of languages, dead or alive, are apt to arrogate to their own tribe the sole monopoly of aesthetic appreciation. They claim the appreciation of art and beauty to be their exclusive preserve, and are very jealous of encroachment by outsiders, particularly from scientists. They have an unhealthy dread of going below the surface of things, for they labour under the illusion that beauty is only skin-deep and any probing below the surface might destroy a happy illusion. Very often, they put forth the presumptuous suggestion that the scientist, because he has the analytic mentality, fails to appreciate beauty of the organic whole, and a botanist would rather dissect a flower than appreciate the beauty of its richly coloured petals. This is a monstrous fallacy. The fact that a botanist knows the chemical composition of Anthocyanins which give rich blue colour to the petals of a flower does not make the flower less beautiful to him. In fact, the professor of literature looks at the flower very superficially and he can appreciate only the external form and colour of petals, and is utterly unconscious of the drama of life which goes on in the anthers, the stigma and the ovary. On the other hand, the botanist not only appreciates the beauty of the petals, but can also envisage the groping journey of the pollen tube in the stigma of the flower, and the fusion of male cell with the egg cell in the ovule. The layman merely admires the rich green colour of leaves and is content. The scientist not only shares the joy of the greenness of the colour of leaves but also

A solitary Colvillea serves as accent material.

knows how chlorophyll, the green colour in the chloroplasts, is busy manufacturing carbohydrate from the water pumped from the roots through xylem tubes, and carbon dioxide penetrating through the stomata of the leaves. Far from destroying the sense of beauty, science has deepened the sense of beauty, and has revealed new beauty before the wondering eyes of men, to admire and to explore.

The Concept of Beauty

Why is a thing or a person beautiful, and what is beauty? Most of us know what is beautiful though we may not be able to explain it. We have an average standard of beauty for the human body, for flowers, and for pictures and statues. Most of us agree with Oscar Wilde when he says that "Beauty is one of the great facts of the world like sunlight or spring time, and the reflection of the moon in dark waters." However this beautiful verbiage leads us nowhere and hardly explains what is beauty. There are some like Anatole France who throw up their hands in despair and say, "We shall never know why a thing is beautiful." But this is not the attitude of mind which leads to explanations of facts and phenomena. Though this riddle has vexed philosophers for ages, it was Baumgarten who included this type of inquiry into philosophy and, to make it respectable, gave it the horrid name of Aesthetics. Where philosophy has failed Biology has come to our rescue, and the inquiry into cause of beauty has moved from the realm of speculation to the realm of objective observation of facts and phenomena, dissociated from anthropomorphism.

Let us move on from the Greeks to the biologists. However, when we talk about beauty we cannot ignore the Greeks who had a passion for athletics, sculpture, and endless talking. The Greeks idolized the athletic youth. This does not stress their homosexual inclinations, though this suspicion cannot altogether be ignored in dealing with a slave-owning community. It is a fact that the Greeks glorified the male youth in preference to the female. One cannot overlook the fact that it is an abnormal phenomenon in the history of the human race, though it has given us the beautiful statue of Apollo Belvedere, the acme of the art of plastic beauty. In their concept of beauty the Greeks stressed the regularity of proportions. Dionysius defined beauty as "Order, symmetry with supreme lucidity." Similarly Aristotle defined beauty as "Symmetry, proportion, and an organic order of parts in a united whole."

The Hindu Concept of Beauty

The Hindus who had a more complete sense of the beautiful have given a more complete definition of beauty. They were not deceived by the shadow for the reality and by its pale reflections thus ignoring life, the original source of beauty. According to them Beauty lies in form (*rupam*) as well as the inmost soul (*rasam*). No one has ever fallen in love with a statue, however beautiful, Pygmalion excepted of course. Even Pygmalion asked Venus to breathe life into his favourite statue, and we do not live in the age of miracles. No one has ever

embraced the Venus of Milo in spite of its beautiful form, for it lacks life, the inmost soul, and is merely a nicely carved piece of stone though carved with due regard to symmetry and proportion and representing an order of parts in a united whole, but dead nevertheless. Beauty is the harmony of the form (*rupam*) and inmost soul (*rasam*). It is only when a beautiful body and a beautiful mind are combined in a person that real beauty results. The Hindu concept of beauty is summed up by Surendra Nath Voegeli-Arya as follows: "Beauty is the Living Harmony of *rupam* and *rasam* which has its roots in Self. Self is the ever-flowering river of Life which has its perennial spring in the Supreme Self, who is the author of all things of Beauty and Joy." While the body must be kept healthy and beautiful by physical culture, the mind must be disciplined by practising principles of Ethics and by self-culture. Excessive attachment to the ideals of asceticism is as bad as excessive attachment to ideals of pleasure and happiness. The path of beauty is the middle path, the compromise of culture and physical beauty.

Primary Beauty

The Hindu concept of beauty approximates Will Durant's when he says, "Beauty is a function of life, and not of matter and form." In human beings it is the beauty of the female body, which is primary beauty, and all else, the beauty of flowers, the beauty of animals, and the beauty of poetry, pictures, and literature is secondary. "I am the beauty of woman," says Paphnuce's vision in Thais. "Whither do you think to fly from me, senseless fool? You will find my likeness in the radiance of flowers, and in the grace of the palm-trees; in the flight of pigeons, in the bound of the gazelle, in the rippling of brooks, in the soft light of the moon; and if you close your eyes you will find me within yourself."

Has the beauty of the female figure any use apart from attraction of the opposite sex? Has the broad pelvis, the rounded breasts, and the soft voice any meaning or function? Even the design of the female body has a functional basis. A design untrue to its function lacks grace, and nature does not waste material on mere uselessness. This will come as a shock to the professors of languages, who in the words of Lancelot Hogben "gloat in the uncontaminated exaltation of uselessness in its most benign form." Beauty of the woman's body is also as functional, as the fusi-form shape of the fish or stream-lining in an eagle. The beauty of the woman's body lies in its curves, and, maternity and maintenance of the species being the function of women, a truly beautiful female body is that which serves the function of maternity best. As Will Durant says: "If we were quite sane we should consider the healthy woman nursing her healthy babe as the summit of beauty in this world. Here the Middle Ages' Renaissance with their Madonnas and the child were finer and sounder in taste than we; misled by a degenerate art we hanker destructively for thin and wasp-like women who cannot reproduce half so well as they can sting." Unfortunately the Madonna has

become a "Cow" in the vocabulary of our so-called modern wasp-waisted chattering slim-crazies who have given preference to the angle for the curve in their blind worship of the goddess of slenderness.

Ultimately it is in sex, the urge to propagate the species, that beauty has its source and from sex it derives its power. All other things are beautiful only in a derivative sense. Fragrance of jasmines is valued for its aphrodisiac effect on the human male. The sense of smell played a more important part in our quadrupedal stage. Even now among dogs and horses the sense of smell has a more important function in courtship, and as Will Durant says, in dogs "the aesthetic tremor comes humbly through the nose." With the adoption of erect posture, the nose lost its former importance and eyes and hands became more important. Thus in man appreciation of beauty has become the combined function of eyes, hands ears, and nose, and, the sense of touch, and the sense of sight have assumed greater importance. Thus sex is the fount of beauty as well as of art, music, poetry, and gardening. Biology has provided an answer to our question. As Will Durant has so ably summed up, "The beautiful is primarily that which is sexually desired; and if other things seem beautiful to us it is derivatively, and by ultimate relationship with the original fount of the aesthetic sense."

Aesthetic Sense

Ultimately aesthetic sense resolves itself into a question of sex glands. Where the ovaries and the interstitial cells of the testes are well developed and hormones are secreted into the blood stream of the individual with vigour and regularity we usually find a well developed aesthetic sense. When the sexual energy is dissipated in sexual orgies, aesthetic sense also ebbs away, and where it is sublimated it gives us sublime poetry, beautiful pictures, great discoveries of science, and love of flowers and gardens. We have a negative evidence in eunuchs. In the entire human history no eunuch has ever become a great poet, painter or a scientist. Aesthetic sense exists among the most civilised human beings as well as among the most primitive. As it is so closely bound with sex glands, it is found even among idiots and insane persons who lack intelligence.

Creation of Beauty

It is not only painters, poets, musicians and dancers who give expression to their aesthetic sense in the form of pictures, poetry, music, and dance, but others also give expression to it in their work when it is of creative type. The chemist who synthesizes a new compound, a cytologist who dissects a cell under the microscope, the surgeon who performs a delicate operation, the cook who makes beautiful puddings and pastries, the potter who makes pots and toys, all give vent to their aesthetic sense, and create beauty and are as much of artists as painters and sculptors. In the joy of creation one escapes from 'Self'. It is the element of impersonality which is a great experience of those who create beauty, and a source of great happiness to them.

Contemplation of Beauty

Aesthetic activity manifests itself not only in creation but also in the contemplation of beauty. When you look at a beautiful picture of the Himalayas by Bireswar Sen, or enjoy the golden splendour of Amaltas or the pink glory of *Cassia nodosa*, you completely forget yourself. Consciousness of 'self' escapes and you become absorbed in the Himalayan scene of snows and a golden sunset and the yellow and pink flowers. This is what all great religions teach. The flowers of beautiful trees teach you how to forget the 'self'. When you have learnt this, lose yourself in a greater cause, the service of mankind, not by renunciation of the world, but by living actively, by promoting education among the illiterate and the ignorant, administering medical aid to the sick and injured, and by producing more food and manufactured goods, so that the entire mankind may enjoy a reasonably comfortable mode of living, which is at present the prerogative of the privileged few.

CHAPTER 3

Our Lack of Aesthetic Taste

IT is a painful admission that a large number of our countrymen lack aesthetic taste. Most people ascribe this to wide-spread poverty in the country. But carefully examined, this assertion is found to be erroneous. There are many poor villagers who keep their mud-built houses scrupulously clean, carefully plastered with blue clay; their women-folk decorating the door-ways with beautiful geometrical patterns. At Rae Bareli, I often saw villagers plucking Amaltas flowers and decorating the horns of their bullocks. On the other hand there are some millionaires who literally roll in wealth and lead exceedingly unaesthetic lives. Aesthetic sense is not a heaven-given gift to certain nations, communities, or individuals, but is found all over the world; and given a suitable opportunity for its expression and cultivation, most individuals will develop a sense of appreciation of beautiful things.

Those who believe in the maxim "Feed the brute, and the rest will take care of itself" are very short-sighted indeed. Man does not live by bread alone. He lives as much on ideas as on bread. History shows that more people have died for the sake of ideas, however erroneous they may be from our present points of view, than for bread. The sustaining value of ideas is one of the outstanding achievements of human development. If man lived merely to eat, drink, and procreate, he would not have advanced beyond the anthropoid level. When he has fed himself, he lifts his eyes to beauty and higher things. Even

the cave-man carved animal and female figures in stone and ivory; and decorated his cave with pictures. There could have been no other motive except to gratify his sense of beauty.

Absence of Aesthetic Values

In our fitful bouts of patriotic zeal, we are too prone to blame the Westerners for all our ills, and after making them scapegoats of our wrath, we feel a smug satisfaction. We blame the Europeans who introduced the "annual gardening and the annual herbaceous border" in our country, as materialistic, and take pride in our so called spirituality. In reality, our middle-classes are grossly materialistic; while their matrimonial alliances are mainly determined by the money and social influence factors, the so-called gardens in the compounds of their houses are in reality mango and kathal groves. Most of them hardly notice the golden splendor of Amaltas or even the scarlet blaze of Gul Mohurs and Spathodeas. They judge a tree from its gastronomical utility and if this criterion is not satisfied, they decide that the tree is harldly worth planting. The profit motive has attained such an overwhelming importance in our lives that we judge things not from the pleasure they give us, but from profits they can pay us and the losses they can inflict upon us.

For such people expenditure on a herbaceous border of annuals is waste of money and purchasing a picture is an unpardonable prodigality. They would not mind if they can manage to secure a free gift of a picture from an impecunious artist, but spending money on such useless objects is for them, an index of feeble mindedness if not positive lunacy. This reminds me of a small incident which illustrates the mentality of our moneyed classes. I purchased two pictures from a well-known artist for Rs 200/- and proudly showed them to a very rich friend with whom I was staying. On seeing the pictures he said that they were rather expensive. I ventured to suggest that I would not like to part with them even for Rs. 400/-. My friend remarked that in that case I could console myself that I had made a profit of Rs. 200/-. So it was the beautiful illusion of profit which alone could please him. As for the beautiful snowpeaks, and glorious sunset effect in the pictures, it was entirely lost upon him—they were useless.

Our Homes

Nowhere else do we find such complete absence of aesthetic values as in the middle-class houses in India. The so-called educated middle-class family appears to be completely unconscious of beauty, and decoration of their houses betrays complete lack of taste. If you have a peep inside their drawing rooms, you will see vulgarity writ large all over the room. The walls are adorned by group photographs taken on the occasions of transfers and retirements, to which are added the dearly-beloved tinsel garlands presented on the occasion of official functions. Among the disorderly mosaic of group photographs and family portraits, you see framed welcome addresses, panegyrics composed by

loyal subordinates on the occassion of official functions, or laments on transfer printed on cloth or paper in golden or invisible silver letters framed in gaudy golden frames. Above the mantelpiece you will find the name of the proud owner of the house painted in a framed mirror such as "Ugly Pershad Esqr., P. C. S., Deputy Collector." On the mantelpiece you will see a cloth with a fringe of beads and on this you will find a dump of Diwali toys, and photo frames reflecting the mental confusion of the owner and his family. Surrounded by mementos of their imaginary social conquests, this class of persons leads a life completely oblivious of art and orderliness.

In contrast with this class you have the petty bourgeoise family where the adolescents control the decoration of the house. These young adolescents lead a romantic existence, falling alternately in love with Leela Chitnis and Greta Garbo. They litter the mantelpieces of their drawing rooms with photographs of their film-star sweet-hearts excised from movie magazines, and plaster the walls with calendars showing these beautiful ladies in seductive poses. There is some consciousness to beauty in such cases, and given a little training they will certainly appreciate prints of pictures of Indian and foreign artists. At least they show better taste than the doctors, chemists, and grocers, who cover the walls of their houses with calendars displaying the virtues of Aspirin, Lily's Biscuits, Kolynos Toothpaste, or Lux Soap.

The Pseudo-Shikari's House

There is another type of house which also deserves mention—the house of the shikari and the pseudo-shikari. On the walls of the house from the entrance verandah to the bed-room, you find an array of mounted heads of tiger, horns of all varieties ranging from small gorals to ramifying antlers of sambhars, heads of black buck, bears, foxes, and even hyaenas. In the sitting room the floor is covered with tiger and leopard skins and in the corners are also stuffed tigers and panthers mounted on easels, snarling at the intruder into their jungle and looking angrily through their glassy eyes. I had once to face an ordeal of dining in a room with the vicious head of a black bear staring me full in the face from the opposite wall. Its horrible red mouth peeping out of grisly black hair, reflecting its death agony, the final spasm of life before the flame of life flickered away for ever, always reminded me of a gruesome tragedy in a far-off Himalayan jungle.

Such decorations could hardly be considered as conducive to a good appetite. The owner of such a house is not only worried about his trophies getting moth-eaten in rainy season, but also feels apprehensive of small children pulling out the bristles of moustaches of his favourite tiger. Even heads of tigers and leopards may be excused, when I recall the experience of having tea in a

pseudo-shikaris' house with a stuffed hyaena hanging on the wall in front. If he had added a jackal to this collection he could have proudly proclaimed himself a possessor of a representative museum of wild animals of northern India. Though most of his trophies were presents from professional shikaris who wanted to oblige him, or acquisitions from auction sale of a club gone bankrupt, he could regale you for hours with his jungle tales, adventures and hair-breadth escapes in the forests of Terai. With the lurking terrors of the jungle in every nook and corner of the house, one could hardly experience a feeling of peace and quiet, and such a house cannot be called a home, when its denizens loudly proclaim that it is a jungle or at the best a taxidermist's shop.

There is a fourth type of home which also deserves mention—the home of the so-called aristocratic classes—our zamindars, taluqdars, petty rajas and nawabs. Like their be-jewelled owners these houses also glitter. In one house I saw the floors plastered with what appeared to be the whole broken china of the town. The shining bits of china framed by Lucknow dirt created a strange feeling of uneasiness. The roof of the hall room which served as a drawing room was covered with chandeliers, glass prisms, and red and blue balloons of hollow glass, while the walls were covered with mirrors. What is the function of this multitudinous array of mirrors, you ask? Perhaps the proud owners feel flattered on seeing their resplendent gold-brocade *achkans* and turbans reflected from so many angles. Above the level of the mirrors you will find group photographs taken on the occasion of dinner or shikar parties arranged in honour of the visit of Governors or Commissioners surrounded by the portraits of the ancestors of Raja of Pankhapore adorned with funny looking whiskers looking down in their barbaric splendour on the people assembled. Not that anything is wrong with such group photographs or portraits. What I want to emphasize is that they are out of place in drawing rooms, and they may be placed in office rooms or other places. On the floor you will see old carved Victorian furniture purchased from Sir so-and-so on the occasion of his retirement. In the corners there are marble cupids, small round tables with marble tops, cluttered all about, leaving hardly any leg-space and there is a danger of upsetting some inartistic treasure or other if you are a little careless. On the mantelpiece there is a chiming clock surrounded by Parisian china dolls, shells of pearly nautilus, and knick-knack of ivory and silver.

Such a house looks more like a curio-shop, or an ill-arranged museum of antiques. On seeing such homes one feels the iconoclastic zeal of Mahmood Ghaznavi. It is time that we clear up these dumps of vulgarity from our homes. Like beavers we go on collecting odds and ends all our lives, and we should also learn to discard unnecessary things, which no longer attract us. Such stock-taking is necessary in every home at least once a year.

'A Wood Nymph'—Replica of a Kushan Sculpture by Shri S. C. Batra.

CHAPTER 4

Forgotten Flowers

FOREIGNERS who happen to see an Amaltas, or a Gul Mohur in bloom wonder at our neglect of such splendid material for beautifying our country. Why have we made no use of this wealth of rich colours, while we make futile efforts to grow cypresses which look so funereal and gloomy? This is explained by our conservatism and lack of imagination. We are wedded to tradition and formalism and our designers of parks and gardens make pitiable attempts to produce clumsy replicas of Moghul and Tudor gardens which seem so out of place in our climate. Secondly, our materialism stands in our way and we judge trees from their economic worth only. Unfortunately most of the ornamental flowering trees with beautiful flowers do not yield edible fruit and I believe the only honourable exception is Kachnar whose buds are curried or eaten in curds. This may be the reason which explains the invasion of gardens of some houses by Kachnar. This reminds me of an incident which illustrates the mind of our moneyed petit bourgeoise typically. While planning the garden of my house at Allahabad I planted only ornamental flowering trees. This was highly annoying to a friend who was looking after this work, and incidentally had a fat bank balance of about a lakh of rupees. He had been expatiating at length on the virtue of planting mangoes and Kathal trees in the compound of my house and was disappointed to learn that I wanted to plant flowering trees only. When he discovered a couple of Kachnars among the rows of ornamental trees, he felt relieved.

The flame-like beauty of Butea flowers lends its glamour to swarthy Santhal girls.

and highly pleased. This was not on account of any appreciation of the purple blooms of Kachnar, but on account of the fact that Kachnar buds are sold in the bazar at eight annas per seer. Personally I would like to leave the Kachnar buds alone rather than boiling or currying them, for they appear far more beautiful when allowed to blossom into a heavenly mantle of pale-mauve, pink and white flowers. This appears to me a bit of vandalism.

Seldom yielding any edible fruit, the ornamental flowering trees have suffered neglect from our ' spiritualistic ' countrymen. It is only rarely now that trees like Asoka and Champak are found growing near temples, and the devotees pluck their flowers for the benefit of their idols. Our ancestors were not prosaic and dull like us. They had aesthetic sense and loved the indigenous flowering trees. That is why Kadamba is associated with Sri Krishna and the red flowering Asoka with Sita, wife of Rama. Where Kosi river leaves the mountains there is a beautiful grove of Asoka trees and the legend is that Sita and Rama were so much enchanted by the beauty of their flowers that they made this grove which is called Sitabani, their home for some time. As the author of *Skanda Purana* relates, "Sita was charmed with the beautiful forest, and said to Rama, 'It is the month of Baisakh ; let us stay in this wood and bathe in the waters of the river.' So they made their abode there, and on their return to Ayodhya, the name of the place was changed to Sitabani, or the Grove of Sita." Sita did not forget the charm of the forest trees and pleasures of baths in the river. Surrounded by the palace luxuries of Ayodhya on return from exile, she still pines for the jungle and says to Rama, "I long once more to wander through the shades of the brown woods, and plunge amidst the waves of Bhagirathi's cool transluscent stream."

Asoka tree is so much associated with the name of Sita, who is supposed to have taken shelter in a grove of these trees when pursued by the lustful demon Ravana while she was in his captivity in Lanka, that it is befitting to call this tree Sita Asoka. This will also avoid its confusion with another tree also called Asoka (*Polyalthia longifolia*) which has dull green flowers and does not compare with Sita Asoka. Red is the colour of passion, love and devotion. It is also the colour of blood and liberty. In eastern countries red colour has an erotic significance. That is why red colour is used in Holi festival by young men for smearing the faces of young women. Red flowers of Asoka are also associated with Kama Deva, the Hindu God of Love. Red is also the colour of the Sun, the source of all life, and of Brahma the creator. It is related in ancient Buddhist books that the father of King Harsha daily offered to the Sun-god a bunch of red lotuses as scores of people even do now in India.

Our Ancestors loved Beautiful Trees

If the degree of development of a culture is judged from the aesthetic level which the people reach, then we can safely say that the Hindu culture

reached its heyday in the period 100 A. D. to 500 A. D., from the reign of Kanishka to the close of Gupta rule. During this period a number of outstanding personalities flourished who have added lustre to the annals of India. Out of the poets and authors of this period names of Asavagosha and Kalidasa deserve particular mention. Asavagosha, the spiritual preceptor of Kanishka, mentions a number of beautiful trees in his *Sundara Nanda* in which he describes the love story of Nanda, brother of the Buddha. He compares the broken-hearted Nanda trying to conciliate his mistress to a " Naga tree (*Mesua ferrea*) broken down by the wind from its excessive burden of flowers." Describing the apathetic mood of Nanda pining for his beloved, he writes, " The Naga trees there, though studded with flowers with yellow interiors as if with gold fitted caskets of ivory, no more drew the eyes of Nanda in his sorrow." In his description of a jungle in the Sub-Himalayas he describes waving kadamba trees, and the Parijat tree (*Erythrina suberosa*) "shining with all the qualities of majesty, and playing the king over the Mandara trees and other trees laden with the bloom of the day, water lilies and red lotuses." Asavagosha compares Nanda's mistress to a lotus pond, "with her laughter for the swans, her eyes for the bees, and her swelling breasts for the uprising lotus buds."

However, it was in the fifth century A. D. when Kalidasa and Vatsyayana flourished that the Hindu mind was fully in touch with nature, the beautiful trees and flowers, and graceful Sarus cranes (Kraunchha birds) with the countryside resonant with their melodious voices. Kalidasa describes the Asoka tree in most of his plays and in his *Ritusanhara*, he gives charming descriptions of most of our indigenous beautiful trees which flower from month to month. In his description of spring he describes the mango tree bent with clusters of coppery red leaves, and their branches covered with light yellow fragrant blossoms shaken by the March breezes, which kindle the flame of love in the hearts of women. He describes the Asoka trees with their graceful drooping young leaves hanging like tassels of silk, covered with coral-red blossoms which make the hearts of young women *sasoka* (sorrowful). He describes jungles of Dhak (Kimsuka) resembling blazing fire waving in the wind, making the earth appear like a newly wedded bride with red garments. How aptly he compares the scarlet flowers of Dhak with the bright red beaks of parrots. In his description of women's toilet he mentions that they paint their bodies with the fragrant paste of white sandal and cover their breasts with garlands of snow-white jasmines, and perfume their beautiful heads with champaka blossoms. In rainy season women decorate their heads with garlands of Kadamba, Kesara, Kakubha, and Ketak flowers. It is thus that Kalidasa describes the toilet of Shakuntala.

The Siris blossom, fastened o'er her ear
Whose stamens brush her cheek;

The lotus-chain like autumn moonlight soft
Upon her bosom meek.

After the Guptas we notice the decay of Hindu culture, and the Hindu mind got so tarnished that it became completely oblivious of the beauty of buteas, erythrinas and bauhineas. Hindu poetry became stereotyped and completely lost the erotic charm of Kalidasa, and degenerated into Bhajans, the so-called devotional songs, the outpourings of sexually repressed puritanical Bhagats and Bhagatanis which are colourless, pessimistic and insipid, and show much concern for the next world for which the devotee was supposed to be preparing by fasting, sexual repression, and prayers. The phenomenon of sexually frustrated women forming " Om Mandali " and posing as Radhikas pining for the love of Krishna, could only occur in a society with a declining vigour which has abjured manual work. The popularity of Swamis and ' Mai Jis ' among old and retired Government servants and businessmen is also an index of decay. Instead of living a full and vigorous life, and making the best of our existence, the believer in the anaemic cult of Bhakti wants to put the clock back, and would rather sabotage all the achievements of science and drag this country back into palaeolithic times. It requires vigorous effort to rub off this rust which has been accumulating on the Indian mind for the last fourteen hundred years; so that the minds of our countrymen become conscious of art and beauty, and they may gaze admiringly at the blaze of Kimsuka flowers, and the golden splendour of Amaltas with the eyes of Kalidasa.

Our ancestors were much beauty-conscious. It is a shame that we, their successors, who claim to be more civilized are aesthetically so dull. For most of us our Amaltas trees decked in golden glory of their graceful pendulous racemes of yellow flowers have been flowering in vain. This also explains why our kachnars with their March mantle of mauve purple flowers have been languishing in obscure corners of our public gardens, and our Lagerstroemias laden with pinkish red flowers have been lying neglected in our parks and gardens. This has been the fate of indigenous trees and as regards the exotics like Browneas, Colvilleas, Peltophorum and Milletias they are known only to the curious few.

Foreigners rediscover our Beautiful Trees

Most of our good things are discovered by foreigners, while we, who live surrounded by them are oblivious of their beauty or merit. Unless a certificate of merit is obtained from a foreigner, a poet, a painter, an author, a dancer, or even a tree has very little value in our eyes. Tagore became known in his own country when the English translation of his poems reached Europe and won appreciation. Uday Shanker's worth was only recognized in India when his dances were extolled in Europe and America. We are grateful to appreciative Englishmen who have helped us in rediscovering our country, and its culture. Havell re-discovered the virtues of Indian art ; Roerich, Smythe and many

others the grandeur of the Himalayas ; and Blatter and Colthurst, the beauty of our trees. It is time that the knowledge of beautiful ornamental trees is disseminated among all people and particularly among younger people, so that their environment becomes more cheerful and colourful and they develop an aesthetic sense.

Talking about popularising art, Roerich says that pictures should find place not only in art galleries and museums, but also in hospitals and even in jails. When art has invaded jails, they will cease to be jails, for a man who can appreciate a good picture will no longer remain a criminal. Similarly a human being who can admire beautiful flowers will cease to be materialistic and his mind will rise to a higher plane. So in the cultural development of a community or a nation, a bio-aesthetic plan has a very important function.

Our poets have plenty of indigenous material for their poems in our beautiful trees, and yet how blind they are to the splendour of kachnar blossoms and even to the golden glamour of Amaltas. We should introduce themes on beautiful Indian trees in *mushairas* and *kavi summelans*, and ask our poets to give us descriptions of Kachnar, Amaltas, Champak and Jacarandas in their poems, so that we may gladden our hearts and revel in the beauty of their blossoms, when their flowers are dead and gone. These poetical symposiums will also afford us an opportunity of giving suitable names to exotic trees which have found a home in our country.

Trees in Indian Art

Our artists are even more blind to the beauty of our trees than the poets. In old Indian paintings we find only conventionalized representations of pink and white Kachnar blossoms or very rarely a few pink lotuses. Thousands of acres are lit up with the scarlet blaze of Dhak flowers in the month of March and yet we do not find a Dhak jungle painted by any Indian artist. We do not find a single satisfactory picture of an Amaltas or Spathodeas, Asoka or an Erythrina, though these are common jungle trees.

A. K. Roy Choudhry is one of the few Indian artists who have painted some of our beautiful flowering trees with success. His "*Santhal Girls*" is a picture of outstanding merit. Against a background of Dhak flowers the pair of swarthy Santhal girls decked with coloured beads and trinkets appear so attractive. The flame-like beauty of Butea lends its glamour to the girls who reflect the glory of the Butea blossoms and provide a pleasant contrast.

One of the reasons for this neglect of flowering tree is the ignorance of the artists who usually come from urban middle class families and never stir out of their school rooms and studios to study nature at first hand. It is time that the curse of conventionalism is lifted from Indian art and the spell of Ajanta which has stifled all originality is broken. It is not implied that the frescoes of Ajanta caves are not beautiful and lack the merit which is commonly

attributed to them. The pictures which Ajanta artists have left us are undoubtedly beautiful creations. They have an appeal to aesthetes for they faithfully represent the every day life of the people of that age, apart from excellence of their technique The artists of Ajanta undoubtedly painted pictures of great merit, but their greatness should not become an Old Man of the Sea on the shoulders of our present day artists. We who live in the twentieth century, the most eventful era in human history, sometimes become victims of escapism, and out of sheer cowardice seek relief from the painful reality which is life by imagining a Golden Age, a *Satyuga* in the past, and peopling it with mythical heroes. We see the sad spectacle of Indian artists who are blind to the beauty of the snow peaks and flower-filled valleys and colourful trees. Our artists should live in the present and observe their surroundings with eyes wide open.

Among our modern Indian artists, Bireswar Sen and Kanwal Krishna have captured the charm and grandeur of the Himalayas. They successfully convey the atmosphere of the Himalayan mountains in their landscapes in glowing colours. In Bireswar Sen's Himalayan pictures we see morning mist lighted by the rays of the rising sun, and fleecy white cumulus clouds floating over the tops of mountains casting fleeting shadows over the red rocks. On the tops of conical snow-covered peaks bathed in golden rays of the October evening sun, we see cirrus clouds tinged in golden hues. Bireswar and Kanwal have opened new vistas of beauty before us, and in charming colours which pulsate with life and joy, they have created pictures of great beauty. And yet they have tapped only one source of beauty, the Himalayas. It is time that others also shake the dead past and escape from the stale themes of Hindu mythology. Only a nation that has no future constantly looks back upon its past, and drugs itself against the realities of the present by dreaming about the imaginary glories of its ancestors. The younger generation of Indian artists should escape from the incubus of the past and try to live in the present. Let them open their eyes to the beauty of their mountains, rivers, and trees. What a wealth of colour is sprayed in our countryside from month to month! India still awaits her Gaugin to paint the Dhak, Semal, and Amaltas trees.

CHAPTER 5

Trees in Indian Folk Songs

"OH, Shisham tree of my village, at least you remembered me", exclaimed an old man as he affectionately embraced the tree. "You are still standing by the roadside where I left you twenty years ago." He had returned from Shanghai to the village of his birth in the East Punjab. Nobody had come to receive him at the railway station, nor could he recognize any of the persons who were present there. He hurriedly left the platform and rushed to the tall, shady tree by the roadside. His attitude symbolized man's time-honoured love for trees.

In India planting of trees has always been regarded as an act of piety. The hospitable shade of a *neem*, a *banyan* or a *pipal* comes as a boon to the weary traveller who has to undergo the ordeal of walking on a dusty, shadeless village road in the countryside. These trees have been sanctified in folklore and religion. It was under the shade of a *pipal* that the Buddha obtained inner light, and many generations of Buddhists have worshipped it as the sacred "*Bodhi*" tree.

To the aborigines of India's jungles, trees mean a good deal more. The words for tree and house are practically the same among some of the aboriginal tribes of India and Ceylon. The Veddas of Ceylon, who still live in the forest, use the Sinhalese word *rukula* for a hollow tree as well as a house, and thus remind us of the primeval times when the ancestors of mankind lived in hollow trees and caves. But as the society changed from the hunting into the agricultural

The Semal tree meditates why are my flowers red.

stage, the tribe continued to hold the ancestral trees in reverence. Though the jungles were cleared for cultivation groves were invariably left in the clearings. The village grove was also the refuge of the dispossessed spirits. Every tree possesses a spirit, as the tribal lore emphasizes and even nowadays the tribesman before applying his axe formally seeks the permission from the spirit of a tree. Certain tribes attributed intellect and consciousness to sacred trees ; rarely indeed a tree was even endowed with the power of speech which could be heard in the rustling of its leaves. A tree may suffer from the evil eye. A slight offence, may annoy the spirit of a tree ; an elephant, it is said, once ate a leaf of a Banyan, and died within three days. Sacrifices are offered to sacred trees, and votive offerings are hung on their branches.

At the birth of a Lama, as the Tibetan legend emphasizes, all the withered trees surrounding the birthplace put forth green leaves to show that a holy child is born. Every country has thus celebrated the tree theme. In Sweden, for instance, a popular ballad describes how, when a young nymph danced, the leaves of a tree accompanied her harmoniously. Similarly, in India again, the legend of the girl who was killed by her brothers and was transformed into a tree has many versions : it has perhaps travelled to every country of the world. The youngest brother of the girl who was innocent, came to the tree to pluck flowers ; the tree spoke in human voice and revealed the tragedy. In another version, the girl was murdered by her step-mother, who openly repented for her evil act when a minstrel sang at her door ; it was merely by chance that the minstrel cut a branch from the tree that grew out of the blood of the girl, and with this branch he made the bow for his *sarangi* that produced a most heart-rending lament.

A group of tree legends centres round the magical qualities of certain trees. For instance, it is said that a tree grows over the tomb of Tansen, the famous musician of Akbar's durbar : anyone who would chew its leaves would attain an exceptional sweetness in his throat. The attendant ladies of Lalla Rookh aptly assert that the poet, who sang love songs to the princess, must have chewed the leaves of the tree that stood over the tomb of the great musician.

In aboriginal India, the bride and the bridegroom are asked to walk several times round a tree before the marriage takes place : the bride smears the *mahua* tree with vermilion, and embraces it. The bridegroom, on the other hand, performs a similar ceremony with the mango tree.

The legend of the origin of the mango tree shows the poetic flight of the Indian folk mind. The daughter of the Sun God threw herself into a pool to escape the persecutions of an enchantress, and changed herself into a lotus. A king saw the lotus flower, and desired to possess it. But the enchantress burned it from the ashes of the lotus arose the mango. The king saw the flower

and fruit of the mango, and he decided to keep the ripe fruit of the mango with him : as the fruit fell on earth, from it came out the daughter of the Sun God who was recognized by the king as having been his former wife.

Perhaps, at every birth in the village the mango tree sends forth green leaves. Thus even today, as the Hindu tradition maintains it, new mango leaves are brought and hung over the door of the house where the house-wife gives birth to a son.

An attempt to discover the tree theme in the vast panorama of India's folk songs must take into account the great funds of legend and religious belief from the five thousand years old Mohenjo-Daro period down to recent times.

As one surveys the tree theme that has directly or indirectly touched the mind of the folk singers, one finds scenes from the daily life of the past depicting a society of lovers of trees coming back to life. To plant a *pipal* or a *banyan* near the village temple or by the roadside has been recognized for ages as a great social act.

In almost all Indian languages trees form the subject of many folk songs. Sometimes they are used as mere pegs to hang human emotions on, and they become symbols of man's joy or grief. Occasionally they are personified and express their own feelings as in the following song :

The *semal* tree meditates :
Why are my flowers red ?
Why are not my flowers offered to gods and goddesses ?
Why doesn't the Mali make garlands of them ?

In the *Song of the Trees* translated from the Kashmiri, the trees are again personified to give expression to their sorrows.

I, the gardeners's daughter, longed for a mate,
Slowly, slowly, the new spring came.
The apricot tree made a request to God :
I am named ' the late comer ' ;
So early though I blossom ;
I shall be useful to the peasant at wedding-time.
Slowly, slowly, the new spring came.
The *Phrastan* tree made a request to God :
I am named ' the auspicious one ';
Why bear I no fruit ?
The peasant stands awaiting my fall,
So that he may use me as a beam for his house roof,
Slowly, slowly, the new spring came.

The *Chenar* tree made a request to God :
I am named ' the goddess ' ;
Why bear I no fruit ?
Though my cool shade pleases the whole world.
Slowly, slowly, the new spring came,
The willow made a request to God :
I am named ' the hero' ;
Why bear I no fruit ?
Alas ! in my youth my body becomes hollow.
Slowly, slowly, the new spring came.
The pear tree said before God :
I am named pear and fruit I bear ;
I give cool shade as well,
It pleases the Bahavakhar,
Slowly, slowly, the new spring came.

This song has assumed different versions from village to village, yet the central theme is never altered.

" Father, never cut this *neem* tree," is the beautiful opening of a song from the United Provinces. Translated from Awadhi, it is classified as *hindole ka geet*, or swing song. When sung in chorus collectively by young girls on swings, it creates an unusual thirll :

Father, never cut this *neem* tree,
The *neem* offers rest to sparrows.
Father, never trouble your daughters,
Daughters are like the sparrows.
All the sparrows will fly away,
The *neem* will feel so lonely.
For their father-in-law's will all the daughters leave.
Mother will feel so lonely.

The *neem* symbolizes the mother to whom daughters are like sparrows; when they leave it for their new homes the tree feels lonely like the mother whose daughters leave her, one by one, as they get married.

A fragment from a mystic song of Kashmir brings the Deodar in bold relief. Thus sings the mystic in the mood of a lover :

In the forest I stood as a strong Deodar,
To lay me low there came to me the invincible angel of death ;
Such was my fate,
I lost my houri while yet I was young.

A marriage song, translated from the Marathi, also deals with the tree motif. It is sung while the people are busy erecting the *mandap* or the marriage marquee.

The mango tree talks to the *jambul* tree,
Let us go and invite the *umbar* tree,
I had sown the *umbar* seed.
Thirty three crores of gods witnessed it;
Let every tree be an *umbar*, O *umbar* tree.
Your branches have spread everywhere,
One has gone to the sky,
The other has gone to the underworld,
The third has come to the *mandap* of Ramraj.

The following song from the Punjab is an epitome of the vicissitudes through which a sapling has to pass before it grows into a tree:

Tree, O tree, said the parrot,
Firstly, your soil is bad,
Secondly, your stem is old.
Neither my soil is so bad,
Nor my stem so old.
Firstly, the Nabob Sahib's she-camels have eaten me,
Secondly, the carpenters cut away the beams,
May the mourners in batches visit the carpenter's houses,
May the Nabob's she camels all expire,
And may the wise old Nabob himself too expire.

Another song from the Punjab provides a peep into Indian village life. It is sung by a girl whose soldier husband is away in a distant cantonment and does not care to write to her:

O *pipal* of my birthplace,
Your shade is cool;
Water in our pond is dirty,
The leaf-powder from its surface I set aside.
Lachhi and Banto have gone to their husbands,
And whom shall I tell my story?

Often the tree has its tale of woe to tell as in the following song from the Simla Hills:

O cruel wood-cutter,
Cut merely my lower branches;
Do not stretch out your axe towards the top,
O leave it for the birds' nests.

In aboriginal India, songs are wedded to dance. The song given below is sung in chorus by the Maria Gonds by Bastar State in praise of their land:

In our land, O girl,
Oh, in our land, dear girl,
Stretching our hands we can pluck the mangoes, dear girl.
Oh, stretching our hands we can pluck the mangoes, dear girl,
Never a scarcity of mangoes, dear girl,
Oh, never a scarcity of mangoes, O girl.
If you drink toddy, O girl,
Oh, if you would drink toddy, dear girl,
You would drink to your heart's content, O girl,
Oh, you would drink to your heart's content, dear girl.
Gods with their own hands, O girl,
Oh, gods with their own hands, dear girl,
Have planted the palm tree, O girl,
Oh, they have planted the palm tree, dear girl.

Verrier Elwin has a *Karma* song from Rewa : the Gonds follow the method of direct statement :

Plant the mango, plant the tamarind and plantain :
Clusters of fruit will weigh their boughs.
Plant ten *kachnar* trees for flowers ;
In a garden set the *tulsi*.
Water them unweariedly, but they will always wither.
But the trees in the forest,
Which depend on God alone,
Never wither and die.
The forest trees grow always.

Trees can always add colour to life. Tribal poetry everywhere gained in power and charm whenever it touches the tree motif.

The *Jangalies* of the Punjab sing scores of *Dhola* songs with a common opening address—" *Butt Vanotia* !" *Vanota* is the *peelu* tree (*Salvadora persica*) which is known as *jal* in the West Punjab. *Vanota* is from Sanskrit *Vana* or forest. It means that *peelu* is the lord of the forest. *Butt* means body or ' living personality '. Thus, *Butt Vanotia* may be translated as " O living *peelu* tree ! " Here is a popular Dhola song that opens with the symbolic address :

O living *peelu* tree !
Your roots are gone deep into the jungle,
Well shaped is your stem since your birth,
Over it your branches have added colour.
My neighbours are all ready for the journey,
Drums have announced the news.

Undoing my hair, I have turned an ascetic woman.
I have put on the sacred thread of *mala* ;
Following your path, I searched for you in streets and lanes.
In what town should I search for you now ?
I enquire from astrologers and Brahmins,
No prediction has so far told me the path you followed indeed.
Across the river I stand—I, a woman who cannot swim,
Bundle of clothes in hand ;
Bring your boat here, O boatman,
How can I stand here waiting and waiting ?
Lo ! I fall on the earth, seek my death,
Turn but once your she-camel homeward,
Once at least you can bring life to a poor soul like me.

This is the method of the *Jangali* folk songs ; the woman represents the human soul, and the never-ending search of the soul for God is the theme of the *Dhola* songs. Again and again, the *peelu* tree is addressed in the opening line of the *Dhola* song as if it understood the human voice, and, when the search for God seems to bear no fruit, the singer looks towards the old forest tree for advice.

The tree motif is dear to the village mystic ; in varying forms it usually adds to the vitality and depth of feeling of the singer as seen in the following pieces from the Punjab.

i

O dry *pipal* leaf, why are you rustling ?
Fall now, old leaf,
Lo ! the season of new leaves has come.

ii

Listening to the songs of trees.
My heart is illumined.

iii

The *pipal* sings; the *banyan* sings,
And the green mulberry, too :
Stop, traveller, and listen,
Your soul will be set right.

iv

Under the *banyan* tree
I happened to see God Almighty.

v

Tell me, O *pipal* tree,
Which is the path to Heaven.

The scarlet red flowers of Dhak are associated with lovers and romance.

vi

O silent *pipal* tree,
Do open the knot of my soul.

vii

The *banyan* knows the secrets ;
No good telling a lie in its presence ;

But the mystic appeal cannot be shared equally by all. Generally speaking, it is the life of the people that provides a fertile soil for the tree motif. Here are, for instance, few Bhojpuri Birha songs :

i

The bamboo-grove where I played with friends,
O it never fades from my mind ;
A lute shall I make of bamboo from the same forest
The Birha shall I sing from door to door in the village.

ii

Our goddess feels hungry, brother,
She asks for milk to drink.
Shall I milk the *banyan* or the *Barohi* tree ?
My *Raina* cow has gone a long way off.

iii

Rama and Lakshmana left for the forest,
And Sita accompanied them ;
Rama and Lakshmana felt thirsty,
Sita gave them nectar mixed with water.

iv

In one forest an ant wanders,
In one forest a cow wanders ;
In one forest wanders the daughter of the Ahir mother
With bells fastened on her breasts.

v

The east wind blows and I just yawned ;
While standing, my body is filled with lassitude ;
Who is the dandy whose gaze fell upon me ?
The home and the forest, O neither of them would please me.

vi

No more looking after the cows,
No more bathing in the Ganges,
No more friends' company under the *neem* tree,
These three things God Almighty took away from me.

vii

On the branches of the mango, a bunch of mangoes looks lovely,
In the forest, the *palas* trees are blossoming ;
In the lap of the fair bride the child looks lovely,
As though the moon appeared on the sky.

viii

On the branch of the mango the *koel* sings,
In the forest the peacock dances ;
On the river bank I sing my Birha,
It pierces the heart.

Again and again one wonders how much the Indian folk songs owe to the tree that add colour to the local landscape. The villager, as he takes to the oldest songs, conjures up the past. One may say that even a mere reference to a tree is a reminder of the past, for it reminds the singer of his ancestors who lived in the forest in olden days.

The Uraon folk songs from the western half of Chota Nagpur bring out images of trees, and, as W. G. Archer observes, "it is not easy to comprehend their symbolic significance without actually understanding the whole process of tribal life":

i

Under the *pipal* tree the black cows are sitting
A heron sits on the *pipal* tree ;
Who was the girl who broke a branch
And sent the sitting heron flying from the tree ?

ii

The tiny tamarind
A shining shelter
Hare haire.
Come, my gallant, to the spring
Come, my gallant, to the spring
And I shall dash your clothes with water.
Hare haire.

iii

You, old man, knocking nuts of the *Karanj* tree
And the *Karanj* bloom falls
You, old woman, the nuts fall faster than you pick them
And the *Karanj* bloom falls.

iv

Very small the *mahua*
Many the branches

On all sides falling
Hare haire.

v

Which is the bird that sat on the *Karam* tree, woman?
The branch of the *Karam* tree broke, woman
The *piyo* bird sat, woman
The branch of the *Karam* tree broke.

" It is considered both meritorious and exciting ', says Verrier Elwin, " to plant trees. The Gond or Pordhan who does this generally has a great desire to perpetuate his name, and look forward to a prosperous old age. "

We may mark this phase of aboriginal life in the light of the following Gond folk songs:

How young I was
When I planted the mango
And the tamarind
And still their leaves are full of life
But there is none in my old body.

Verrier Elwin rightly says that " The old man who planted mango and tamarind trees in his youth finds himself jealous of the vigour of their fresh green leaves and contrasts it with the lack of strengh in his own limbs."

Here is a Bhil song translated by D. P. Khanapurkar. It seems to bring out the *pipal* tree as a symbol of grace and character in view of the names of the chiefs of the Dangi Bhils which are mentioned in the song:

Oh, King Somansing,
Your throne is of gold
Oh, it is of gold
Your speech is silvery
Oh, it is silvery
Oh, *pipal* tree,
Your leaves appear golden.
Oh, King Chandarsing,
Your throne is of gold
Oh, it is of gold
Your speech is silvery
Oh, it is silvery,
Oh, *pipal* tree,
Your leaves appear golden.
Oh, King Sahebu,
Your throne is golden

Oh, it is golden
Your speech is silvery
Oh, it is silvery
Oh, *pipal* tree,
Your leaves appear golden.
Oh, King Anandrao,
Your throne is of gold
Oh, it is of gold
Your speech is silvery
Oh, it is silvery
Oh, *pipal*, your leaves are golden.

The image of the elder brother's wife persists in many hill songs, as also in another Garhwali song that centres round the willow (*Majnu*) tree:

Who you are, O man, sitting in the shade of the tree?
Besides water stands *Majnu* tree.
Sitting in the shade, do not break its branches.
Who you are, O man, sitting in the shade of the tree?
Besides water stands *Majnu* tree,
My uncle built its stone enclosure,
My aunt brought stones and clay.
Who you are, O man, sitting in the shade of the tree?
Besides water stands *Majnu* tree.
My brother got it fenced,
Steadily did my sister-in-law nurture it.
Who you are, O man, sitting in the shade of the tree?
Besides water stands *Majnu* tree.
It stands erect, full of pride,
And reminds me of my dear ones.
Who you are, O man, sitting in the shade of the tree?
Besides water stands *Majnu* tree.
Sitting in the shade, do not break its branches.
It grieves my heart
To see it assailed.
Who you are, O man, sitting in the shade of the tree?

Most hill songs are built round trees and are sung at village rituals. The following lines taken from different sources are good examples of this type of folk songs:

The cones are growing on the pine trees,
The *deodar* trees have borne *koka* cones;

O I saw men, many men,
But your glances are unique.
O green *koomshi* plant of the valley,
You are green, ever green:
O I'll win the man of my heart,
Else I shall die.
The young man left me stealthily,
Kindling the fire of love in me—a branch of a tree.
On the hill-top stands a *Jaru* tree
Flowers blossom on the *Jaru* tree;
One flower for you, darling,
One flower for me.
On the hill-top stands a mango tree,
The pollen appears on the mango tree;
One blossom for you, my boy,
One blossom for me.
On the hill-top stands the *mahua* tree,
Flowers blossom on the *mahua* tree;
One flower for you, darling,
One flower for me.

The tree motif, either forming the background or the theme itself, is also seen in the following South Indian folk songs, translated from the Kanarese :

It is cool under the *neem* in summer,
The Beemrati river, too, is cool, mother,
You are cool at my birth-place.
The bird of the sandal forest flies swiftly,
He must be knowing the secrets of the trees, mother,
He loves the fragrant breeze.
The fig tree stands at the door of the barren woman,
Parrots sit on every branch and say:
'O barren woman, your life is for others.'
Better be mud than a barren woman,
For on the mud will grow a tree
Giving shelter from the sun to the sons of man.
Says the landlord, "Trees are green but you are withered."
I say, "I will die to be born a tree on earth!"
Blow, blow, O sea breeze, tell your tale,
The landlord never hears our wail,
O Earth, O Sun, I see no justice.

The road to the weekly market is lined with trees,
At the weekly market I left my boy,
The trees kept away their flowers with grief.
Safe are the sandal trees ; we are planted by the gods ;
We love the land where the peacocks dance,
And the sandal trees are our companions.

Some Punjabi songs mention the sandal tree as in the *Song of Lachhi.*

Aha, where Lachhi washes her face,
There a sandal grows—where Lachhi washes her face.

Another Punjabi song brings in the *shisham* and mulberry trees :

Where shall I plant the *shisham* trees—
All full of leaves ?
O my youth with a slim body,
Where shall I plant the mulberries ?
Oh, the old fool would not follow me.
In the garden shall I plant the *shisham* trees—
All full of leaves.
Oh my youth with a slim body,
At the door of the house shall I plant the mulberries.
O, the old fool would not follow me.
Full one span have grown *shisham* trees—
All full of leaves,
O my youth with a slim body,
Full one span have grown the mulberries.
Oh, the old fool would not follow me.

The old fool is the lover himself who would not help the girl in planting the tree, and it seems, at every step she is thinking of leaving him for good.

In its earliest forms, the Indian folk song was inseparable from the tree motif, as the community lived close to the forests and was never cut off from the real roots of inspiration.

Man has always taken pride in his relationship with trees. Since early dawn of culture, he has learnt to call every tree by name. An urge to discover something new in the image of the tree may be seen in the poetry of every tribe.

"There is a dumb bird that sits on a beautiful *Sal* tree. Shake the tree, and the bird awakes and sings." This is a Gond riddle. The answer is 'the anklets on the feet of a girl who goes to the dance.' Like folk-songs, even riddles and proverbs of the people in India have been enriched by a frequent reference to the tree motif. And even folk-tales have celebrated the importance and beauty of trees in India.

TREES IN INDIAN FOLK SONGS

Trees have provided inspiration to humanity for thousands of years. While human beings enjoy youth which is only transient, trees remain youthful for many years. Every year they produce new leaves and new flowers which bring joy to us. The annual rejuvenation of trees like *Kachnar* and *Pink Cassia* and their magic mantle of mauve and pink flowers gladden the heart of the lover of a nature. Planting of beautiful trees, which has lately become increasingly popular in India, will provide richer themes for our folk songs and will beautify our country.

CHAPTER 6

Places Susceptible of Bioaesthetic Planning

PUBLIC places which belong to the community as a whole rather than individuals should have priority in bioaesthetic planning. A larger number of persons, especially those who are unable to afford private gardens of their own will thus be able to enjoy the sight of beautiful flowers. Public parks and squares, public roads, platforms of Railway Stations, compounds of hospitals, universities, colleges. and schools, ancient historical buildings under the supervision of the Archaelogical Department, compounds of courts, office buildings of municipalities and District Boards, and dak bungalows of the Public Works Department, Canal Department and District Boards are places in towns which are susceptible of bioaesthetic planning and should claim preference in our programme for the beautifying of our towns and cities. Proprietors of hotels and banks, and owners of new bungalows should also be encouraged and given all assistance in planting of ornamental trees.

Railway Stations

A railway station is the entrance gate of a town. An outsider coming to a town for the first time, receives his first impression of the place from the railway station. An unfavourable first impression requires a good deal of correction later on. A traveller on a long journey forms his opinion

The scarlet glamour of Erythrina freshens the mind.

about a town, which he is too busy to see, from the architecture of the railway station and the appearance of its platforms. He may condemn a town merely because he passed through a ghastly railway station. The fort-like railway station of Lahore with its grim exterior is an example of a barbaric feudalistic architecture tacked on to a beautiful town, and is entirely unworthy of the capital. Its platforms are also frightfully drab. Avenues of Amaltas, Persian Lilac, Peltophorum, and Lagerstroemias will give them a touch of colour, relieving their monotony.

It is only recently that the authorities responsible for running our railways have realized the necessity of calling the architect to their aid, and the railway stations of Lucknow and Kanpur have been beautifully built, and in their buildings we find the best features of Rajput, Moghul, and modern European architecture artistically blended. On the other hand the necessity of planting the platforms and approaches of the railway stations with beautiful flowering trees has not been properly appreciated, and we have yet to plan the planting of platforms of thousands of railway stations.

There is another reason why we should make the platforms of our railway stations gay with flowering trees. Millions of persons pass daily through railway stations in the course of business. The platforms of railway stations are more noticed by the people than any other public place. Only a few go to gardens to acquaint themselves with flowering trees, while they have to see the platforms and approaches of railway stations. By planting flowering trees on platforms of their stations the railway authorities will be not only beautifying them, but also educating the citizen in Bioaesthetics. Planting of railway platforms is the best propaganda which our Bioaesthetic Plan can get, and the Railways will be making a genuine contribution to the cultural life of the country.

We are living in a shrinking world, which is rapidly becoming one. India is no longer an isolated country, which to the foreigners was portrayed as a vast jungle full of snakes, sadhus, tigers, elephants and rajahs. While we should banish poverty by scientifically-planned production of goods, we should efface ugliness by Bioaesthetic planning. The aeroplane has annihilated distance, and the size of the earth has shrunk to 1/15th of what it was before the second World War in terms of the time dimension. This will mean greater contact between the peoples of different countries and tourist traffic in India will increase considerably. So far we have been having cold weather tourists only from Europe and America, but in future we will have tourists from all parts of the world in spring and summer and autumn months also, for these are the months when the Himalayas are at their best and fortunately these are also the months during which most of our ornamental flowering

trees are blooming. Moreover electric fans, air-conditioned railway trains, motor buses, houses and hotels will reduce the discomfort of living in a hot country to a great extent, and the plains of India will no longer remain unbearably hot and uncomfortable as at present. The Himalayan meadows, carpeted with brilliant alpine flowers, the snow-covered peaks of the Himalayas, their pine-scented forests, and brilliantly coloured rocky trans-Himalayas will draw lovers of natural beauty, like a magnet from all parts of the world. What will they see in the plains on their way to the Himalayas? At present we have very little excepting dust, flies, beggars, monkeys and Brahmani bulls for display on our town roads and platforms. If we transform them by planned planting of flowering trees into colourful places, the foreigners will carry happier impressions. Just as the Japanese invite foreigners when cherries are blossoming in their country, we can also call them when Bauhinesa are covered with a mantle of purple and mauve flowers in the month of March and when our roads become a blaze of colour with flowers of Gul Mohur, Amaltas, and Peltophorum in the month of May.

Gate-keepers who live in neat little houses along the railway lines near gates at railway and road crossings should also be asked to plant a couple of flowering trees near their houses. How beautiful these places will appear! Not only railway passengers, but people passing through these places in motor cars and lorries will also be able to feast their eyes on the beauty of the blossoms of Pink Cassias, Kachnars, Amaltas and Lagerstroemias. Those who have to wait at railway crossings when the gates are closed will have something more beautiful to contemplate than the railway signals and the complaint book.

Railways are making huge profits and are spending comparatively little on the improvement of the railway stations and on the planting of trees on platforms. On account of lack of shade, the passengers suffer a good deal of discomfort on exposed platforms while waiting for trains. I had such an experience while travelling in the hot month of May from Rae Bareli to Kathgodam. On return the railway authorities were addressed about planting the platform of the railway station. After the usual correspondence and red-tapism an order came from Lucknow to the local railway officer advising him to put " Pakur branches 4 inches in diameter " in the pits dug on the platform. As there was reluctance to spend money on the part of railway authorities a public-spirited gentleman came forward and agreed to pay a bill for Rs. 20/- which was sufficient to cover the cost of about eighty saplings of flowering trees purchased from Government Gardens at Lucknow and which were enough for planting the platforms of three railway stations. The railway department can easily afford to grow nurseries of their own, for they have the money and they have the men. Only a little

appreciation of flowers and trees on the part of the station masters is necessary, which they can only acquire if they are given some lectures on Bioaesthetics also during their period of training.

Ancient Historical Buildings

Ancient buildings and ruins under the supervision of the Archaeological Department afford endless opportunities for bioaesthetic planting. Those who are in charge of this department have already shown imagination and foresight. The deer park in Akbar's tomb at Sikandra in Agra district is an instance. However planting of flowering trees can be pushed on. The bare hills around Fatehpur Sikri should be planted with Amaltas, which is very drought resistant and has an additional advantage of being secure from the ravages of goats. Besides Amaltas, Dhak, Erythrina, Barna, Yellow Silk Cotton tree and Semal may also be planted in pure formations on different hillocks. Hills swathed in yellow, deep yellow, scarlet, and red colours of the flowers of these trees will look fascinating from the Hawa Mahal. The ruins and temples at Sarnath, near Banaras, Taj Mahal, Itmadud-Daulah, Akbar's Tomb at Sikandra, ancient temples at Bateshwar in Agra district, Jehangir's Tomb at Lahore, Purana Qila Qutab Minar and Humayun's Tomb at Delhi all provide scope for planned planting of ornamental flowering trees.

Banks of Canals in Towns

Towns which have canals and small rivers are particularly suited for bioaesthetic planting. The banks of the canal at Lahore and Kanpur, and the banks of the Gomti river at Lucknow should be planted with *Lagerstroemia flos-reginae*, *L. thorelli* and other moisture-loving trees. It would be desirable to encourage canal irrigation in the other towns as well, for it will provide an incentive for growing of gardens and also for planned planting of ornamental trees. Headworks of canals can also be developed into pleasure resorts with a little effort.

Ghats of Rivers

In India rivers like the Ganges and the Jumna are regarded as particularly sacred, and along their banks we see scores of temples and ghats. Such temples and ghats may be planted with Kadam and Asoka, the sacred trees of Krishna and Seeta. Avenues of Asoka and Kadam at Hardwar and Banaras will not only enhance the sanctity of the ghats but will also add colour and charm to these places.

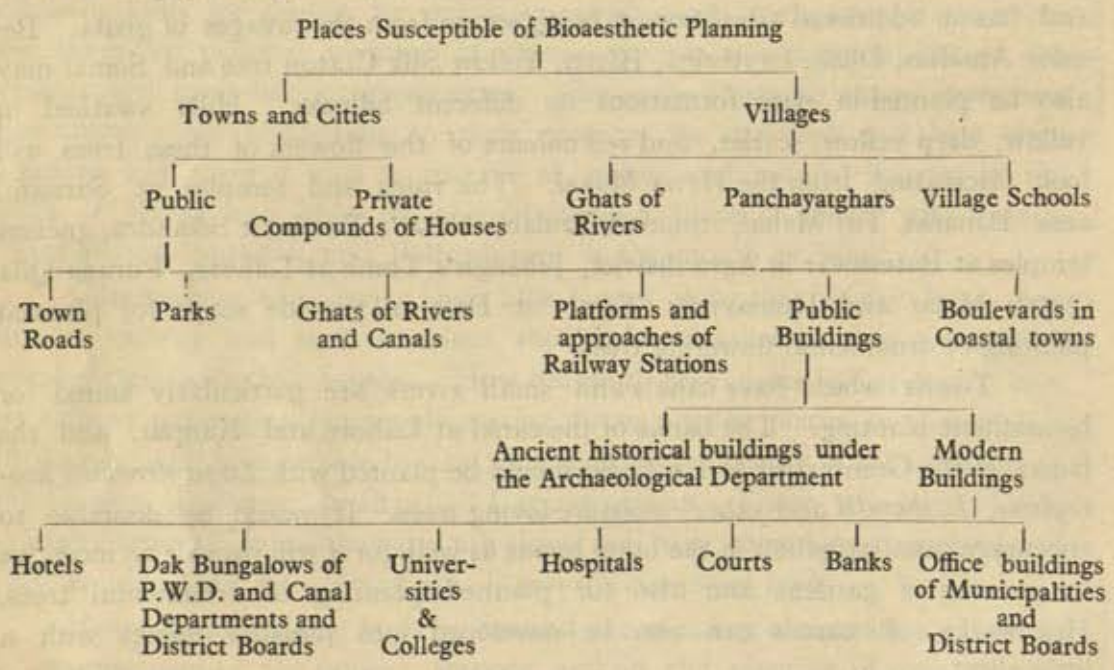
Hotels, Dak Bungalows, and Boulevards

Hotels and dak bungalows which are usually fenced and have well protected compounds and some of which have irrigation facilities as well come within the scope of our programme. The boulevards of coastal towns like Bombay and Karachi can be made into a symphony of colour by planned planting of suitable flowering trees.

The Panchayatghar

We also should not neglect the villages, where village schools, Panchayatghars and temples can be planted with ornamental trees. In the East Punjab, the villagers plant Bakain (Persian Lilac) around the bullock-runs of wells fitted

with persian wheels. These clumps of Persian Lilac not only provide shade for the bullocks and men, but also appear very beautiful in the month of March when they are covered with sweet scented lilac-coloured flowers. The Village Community Houses (Panchayatghars) which are jointly owned by the village and are usually under the supervision of rural development organizers, and panches, the elected representatives of the village, provide ample scope for plantation of ornamental trees. Small nurseries of flowering trees can be raised in the compounds of village schools and Panchayatghars and can serve as foci of tree planting activities.



CHAPTER 7

Colour and Colour Schemes

NEWTON'S discovery that light is composed of seven colours of the spectrum i.e. violet, indigo, blue, green, yellow, orange, and red, is of fundamental importance from the point of view of the scientist as well as the artist. The order in which these colours occur in the spectrum explains the laws of colour harmony and recognition of this fact is the basis of all colour schemes. This order also reveals that some of these colours merge insensibly into others, such as violet and indigo into blue, yellow into orange, and orange into red. There are three fundamental colours, blue, yellow, and red, from which all other colours can be derived by mixing. Blue mixed with yellow gives green, yellow with red, orange, and red with blue, violet.

On Newton's analysis of colours of the spectrum, Root established his table of natural order of colours, and according to him, yellow is the lightest of colours and violet, the darkest. According to their intensity, the colours can be arranged in the following order :

Violet, Indigo, Blue, Green/Yellow, Orange, Red.

Colours, when taken in this order, harmonize with each other ; yellow harmonizes with orange, and orange with red. We also find that orange is deeper than yellow, red deeper than orange and violet deeper than red. Starting the other way round, we find that green is deeper than yellow, blue deeper than green, indigo deeper than blue, and violet or purple is the deepest of all colours.

Climatic conditions and the intensity of sunlight have a strong effect on colours. Brilliant red and orange colours of Dhak (*Butea frondosa*) and Gul Mohur flowers are mellowed by the strong sunlight in tropical and sub-tropical countries in the months of May and June. These colours may appear harsh and barbaric in the dull cloudy atmosphere of northern countries of the temperate zone like Germany and England, but in the brilliant sunlight of the tropics they get considerably mellowed down. Toning down of bright colours like red and scarlet, and orange in hot countries takes place on account of the fact that sunlight in the tropics contains a large quantity of yellow which neutralizes the strength of these colours. This also explains the fondness of Asians for deep colours, like red, orange, and blue. It is also noteworthy that in the extreme northern countries like Russia, Sweden and Norway, the peasants also show a predilection for rich warm colours like orange, red and purple in the decoration of their cottages. In countries with land covered with white snow which reflects light and produces a brilliant effect as in the tropics, these colours produce a pleasing effect. Moreover the preference of the people of these cold regions for rich warm colours can easily be understood by those who have experienced the exciting qualities of red and orange colours. It is also interesting to note that the Tibetans who live in a very cold country also show a preference for red and orange colours not only in their dress but also in the pictures they paint in their monasteries. While the *Lamas* wear scarlet robes, the aura of demons, Bhairavas, and Mahakalas, are invariably in shades of red. The Tibetans not only like warm colours but also excel in painting flickering flames of fire. On the other hand, Arabs who live in a hot desert country show a preference for green, a cool and soothing colour. The relationship between the temperature prevailing in the country and the fondness of the inhabitants for particular colours is very interesting indeed.

Psychological Effect of Colours : Red

Goethe, Chevreul, Ostwald, and Schopenhauer have advanced various theories about the psychological and physiological effect of colours on man. Red, yellow, and orange are active colours, and green, blue, and violet are passive colours. Red is the colour of blood ; it is the colour of warmth and passion. If one looks at a red surface for long, one feels as if the colour is penetrating the eyes. It produces extreme excitement. That is why red colour has been adopted by revolutionary parties like the Communists and the Nazis. In India, red colour is associated with Kama Deva, the god of love, and the scarlet red flowers of Dhak and Asoka are associated with lovers and romance. It is also noteworthy that red is the colour which mainly acts upon birds. It is also the first colour that appeals to the awakening colour sense of children and to primitive man.

Yellow

Yellow is the colour of light. It is a pleasing colour which can be used in interior decoration of houses for brightening rooms with a northern aspect.

Orange

Orange, which is a combination of red and yellow, combines the warmth of red and light of yellow. In pictures, orange colour is used for portraying aura of saints and religious leaders, to represent devotion, feeling and knowledge : the highest form of psychic activity we associate with such persons. Orange is also the colour of the sun-rays and gold the colour of the highest power. Orange and yellow curtains and cushions can go a long way in brightening a dark dull and cold room in winter. The orange colour of Spathodeas, Gul Mohur, Scarlet Cordia and Colvillea will brighten any compound, adding warmth and gaiety. The yellow gold-like colour of Amaltas and Peltophorum can be used for brightening the compounds of our houses and the roads in our towns.

Blue

Out of the passive colours blue is the purest and quietest colour. It has a soothing quality. It is the colour of space and infinity. In Tibetan art aura of the Buddha is painted in blue. Though blue is a passive colour, its passivity is of a positive nature unlike green colour. If a room is painted in blue, it appears bigger, and if painted in red, it appears smaller. The soothing effect of blue curtains in a room during summer is known to all who are sensitive to colours. It is a cool and restful colour which has a special appeal to us during our hot summer. Unfortunately there are only two trees which are known to us in India which produce blue flowers, the Jacaranda and the Lignum-Vitae tree, the Tree of Life. Those who have seen Jacarandas in bloom in the month of April in the Forest College at Dehradun, and in one of the circles near the Council House, New Delhi, will agree that this is a very desirable tree for spring. The Lignum-Vitae tree—which flowers throughout the year—deserves greater popularity in North India, and on account of its small size and slow growth is particularly suited for compounds of small houses.

Violet

From our point of view, purple (violet) is another colour which deserves mention. Describing this colour Anagarika Govinda writes : " The third passive colour, violet, is perhaps the most difficult because it is the most complicated and protean colour (it shares this protean character with the sphere). It combines the most intensely active (red) with the most quiet and passive colour (blue). It contains an enormous inner tension, a tendency of transformation (Shiva) even of dissolution, of inner movement and struggle". Purple was extensively used by the Greeks, Romans and Assyrians and the dye-stuff was known as Tyrian purple, as it was manufactured in Tyre. In Christian symbolism, it is the colour of spiritual suffering, of passion. Out of our selected ornamental trees, the Brinjal Trees (*Solanum macranthum or S. wrightii*), is the only tree which produces purple flowers. With its broad spreading leaves, it is an altogether desirable plant and planted alternately with Jacarandas, it looks beautiful in the month of April,

when both these trees are flowering It may, however, be noted that the Brinjal tree produces flowers throughout the year.

A Plea for Colour

We are learning drabness from Europeans. Grey clothes may suit women in the cold temperate countries of the West, but they appear very drab in our bright and sunny country. Even in Europe, we notice a revolt among the members of the fair sex against grey and buff colours. In summer months women dress themselves in gaily-printed skirts and blouses and add colour and charm to public parks and gardens. Blonde women appear particularly attractive in red and orange embroidered Hungarian blouses. Orientalism in taste for colours has been propagated in Europe mainly by the Hungarians and the Russians, nations which combine the efficiency of the West with artistic temperament and idealism of the East. European dress materials have been profoundly influenced by the Russian ballet, through the magnificent dress designs in colour of Bakst, Roerich and Benois. Most of these colourful dress designs were imitated by Pagnin the famous Parisian costumer, and from Paris they spread all over Western Europe. Our Indian women, draped in their brilliantly coloured saris, appear graceful, picturesque and romantic. On the other hand, it must be admitted that our men in their dhoties and clumsy clothes appear unattractive Though I do not advocate the use of brilliant colours for the dress of men excepting in their shirts and neckties, I most strongly urge the brightening of our houses by the use of colours, paints, and ornamental flowering trees. Don't be afraid of colours. Judiciously used in light hues colours can enhance the beauty of our houses.

The pink dining room, light yellow sitting room and light blue, and light green bed rooms in a house of a friend at Allahabad are an example of the judicious and artistic use of colours in a small house belonging to a man with moderate means. Pink napkins and towels always enhanced the pleasure of dining in his house. The owner of this house is by no means an artist or a connoisseur of art, but has an instinct for colours and in such matters instinct is sometimes a better guide than training in an art school.

Another matter in which we lag behind is the use of paints for wood work. Once a house is built, it is built for ever. No one thinks of painting and renovating the wood work. Various shades of blue, yellow and green can be used with considerable advantage in our houses. Nothing appears as attractive as some white-washed houses in Spain with blue-painted doors and windows. Our country—which resembles Spain in sunniness—can hardly boast of such houses. Lastly, at the risk of repetition, I again advocate the planting of ornamental flowering trees to brighten up our towns and villages.

Colour in Objects

Why do objects appear of different colours? Why are the Semal flowers red, the sky blue, the leaves of trees green, and the Amaltas flowers yellow

and clouds at sun-set golden yellow and orange? As has already been stated, the so-called white light of the sun is in fact composed of seven colours : violet, indigo, blue, green, yellow, orange and red. Just as a prism splits the light into its component colours the particles of moisture in the air also act as prisms, and produce the familiar rainbow. Light is a series of waves in the ether, and measured from crest to crest they are of different lengths. The shortest waves give us a sensation of violet colour, and the longest ones of red. An object appears red, because it absorbs the remaining six colours of the spectrum and reflects the red. A piece of cloth appears white, because it reflects the whole of light, and black, because if absorbs all the light. The sky appears blue, because the fine particles in the upper layer of the atmosphere catch the shorter blue waves and scatter them. The sky appears golden yellow or orange-coloured at sun-set, because the sun's rays have to pass through denser mass of air when the sun is low on the horizon, and the sky is full of minute dust particles, and the shorter blue waves are absorbed, and the longer yellow, orange, and red waves are reflected and scattered. The dust particles and water droplets in the atmosphere firstly scatter the blue-violet, and then the green components, thus causing the light to change through yellow into orange, and red. After the close of monsoons in September and early October, the air is full of minute drops of water and dust particles. This explains why we see beautiful sunsets in India in the latter part of September and first half of October.

Colour in Flowers

Development of colour in flowers is, geologically speaking, a comparatively recent acquisition. In the Mesozoic period there were no coloured flowers, and green was the dominant colour in vegetation. Not only were the leaves of Conifers, and other pine-like or fern-like trees which existed during that period green, but their cones, both male and female, were also green. These trees depended upon wind for the carrying of pollen to the female cones containing the ovules, which shelter the female egg, and ultimately ripens into a seed. Billions of pollen grains were produced and only a few managed to reach the female cones. Any one who has the experience of shaking the branch of a pine-tree bearing the male cones, can envisage the tremendous waste of pollen which this primitive method entailed.

It was in the Cretaceous period that the evolution of flowers with male and female parts grouped together and enveloped by bright coloured petals supported by sepals took place through the agency and co-operation of certain insects. The evolution of bees and butterflies has gone hand in hand with the evolution of beautiful shapes and colours of flowers. In fact, the evolution of flowers and of bees and butterflies is complimentary, and without bees and butterflies, there would have been no gaily-coloured and sweet-scented flowers,

and without flowers with their stock of nectar and pollen there would have been no bees and butterflies. The primitive flowers were green and without scent. Some of them developed patches of colour by variation, and particular types of insects were attracted by them. This association grew to their mutual advantage and in the course of time through natural selection we got the beautiful flowers in all their loveliness of colour and pattern.

The association of bees and butterflies and flowering plants is so close and intimate that one without the other cannot exist. Clover depends upon humble-bee for its pollination. White clover was introduced in New Zealand in early nineteenth century, but it did not seed there till the humble-bee was introduced in 1842. An orchid was discovered in Andaman Islands with a labellum 14 inches long. Later on, it was found that there was a butterfly also which had an equally long proboscis and pollinated this curious flower. Most of the foreign trees with bright orange and red flowers like Spathodeas and Colvilleas, are pollinated by small birds with long pointed beaks, the humming birds. It has been noted that most of the foreign trees introduced in our country fail to set seed. While in some cases this may be due to change of climate from humid and tropical to dry and cold temperate, in others, it is due to the absence of birds and insects which pollinated them in their native countries.

Bees are attracted by blue colour and can also see ultra-violet rays which are invisible to the human eye. Dogs, cats and cattle are colourblind The popular belief that bulls can see red colour is not supported by any scientific evidence. A bull cannot distinguish red from dark grey, though he will get excited by any waving bright coloured piece of cloth. Monkeys, on the other hand, can distinguish colours. Experiments with pigeons and poultry by covering their eyes with various kinds of coloured spectacles and by feeding them in different colour zones of the spectrum have shown that they can see red, orange and yellow, while they are insensitive to blue and green. This explains why humming birds are attracted by orange and scarlet flowers.

Flowers and plant pigments

Colour in flowers is due to the presence of certain pigments which are produced by the action of sunlight. The green colour of plants is due to the presence of chlorophyll, a pigment which is associated with two yellow pigments, carotin and xanthophyll. Associated with these pigments we find another class of pigments called anthocyanins in the cell sap of plants. Red and blue colours in petals of flowers are due to anthocyanins. When the sap is alkaline the colour is blue, and when it is acid or neutral, the colour is red. As the sap is usually acid, various shades of red colour predominate in the colouration of flowers. Contrasting with anthocynanins, the sap pigments are protoplasmic pigments which are responsible for yellow colours, and in bright

yellow flowers, these pigments predominate. Pale yellow flowers owe their colouration to an anthocyanin. Orange and scarlet colours in flowers result from the occurrence together of pink sap pigments and yellow protoplasmic pigments. When all pigments are completely eliminated, white colour results. Most of the white flowers are pollinated by night flying insects. There are some flowers which are white in the morning when they open from bud-condition and become coloured in the evening. The colour change is due to the action of oxygen liberated during photosynthesis on the pigment of the cells of the petals. A typical example is that of the Brinjal Tree (*Solanum wrightii*) in which one may see an odd mixture of old purple flowers with newly opened white flowers.

CHAPTER 8

Trees and Their Habitat

BIOAESTHETIC planting of ornamental trees has a close relation with plant ecology, and study of ecology is essential for the bioaesthetic planner. He must place plants in habitats which approximate to their natural surroundings. The texture of soil, amount of rainfall, presence of rivers, canals and tanks, and temperature play an important role in the growth of trees. There are certain trees which flourish only in moist districts with a rainfall of over 40 inches, or along the banks of rivers, canals and tanks. In districts with less rainfall, these trees can grow if artificial means of irrigation are available, but they never acquire the same stature as in moist areas. This does not mean that such trees should not be grown at all in dry areas. If means of irrigation are available these may be grown. A dwarfing in size takes place when trees which are inhabitants of moist districts are grown in dry areas, and this is an advantage when considered from the point of view of the owner of a house with a small compound. *Lagerstroemia flos-reginae*, which is a big tree in Bengal, is a medium-sized tree in the Punjab and the United Provinces. The trees which are suited for moist localities are shown in Table I.

A scrutiny of Table I shows that out of trees selected for moist areas, the majority are natives of foreign tropical countries with heavy rainfall and high humidity.

Dhak—the only tree which grows successfully on saline soil.

On the other hand in the list of selected ornamental flowering trees for dry areas, (Table II) are trees which can stand drought and shortage of water. These are trees with special structural modifications which enable them to cope with dry conditions, heat, and shortage of water. Out of these there are some trees which are indigenous and thus ideally suited for dry tracts of our country. These trees with xerophytic features can flourish in dry areas where irrigation facilities are poor and hot dry winds check the growth of trees. These trees can tolerate arid conditions, but this does not mean that they love drought and heat. They can grow in moist districts as well and thrive very well indeed.

Moisture loving trees

However, on the banks of a canal, a river, or a tank, moisture-loving trees are to be planted such as *Lagerstroemia flos-reginae*, *Salix tetrasperma* (willow), and *Sapium sebiferum* (*makhan*). The last one which is also known as the Chinese Tallow Tree is a medium-sized deciduous tree whose leaves display lovely autumn tints and is used for stream training in Kangra and Jhelum districts.

There are very few trees which can grow in marshy waterlogged areas. *Eucalyptus rostrata* has proved a success in waterlogged areas near the Upper Jhelum canal in the Punjab. Willows and Tamarix are also suitable for such areas. Where adequate protection against animals is available bananas may also be tried. These trees can also be used for draining puddles which form near wells in our villages. It is suggested that these puddles should be enclosed with brick-walls to protect the young trees from cattle, and planted with the trees mentioned above. Where the soakage pits have failed to drain, these trees might succeed.

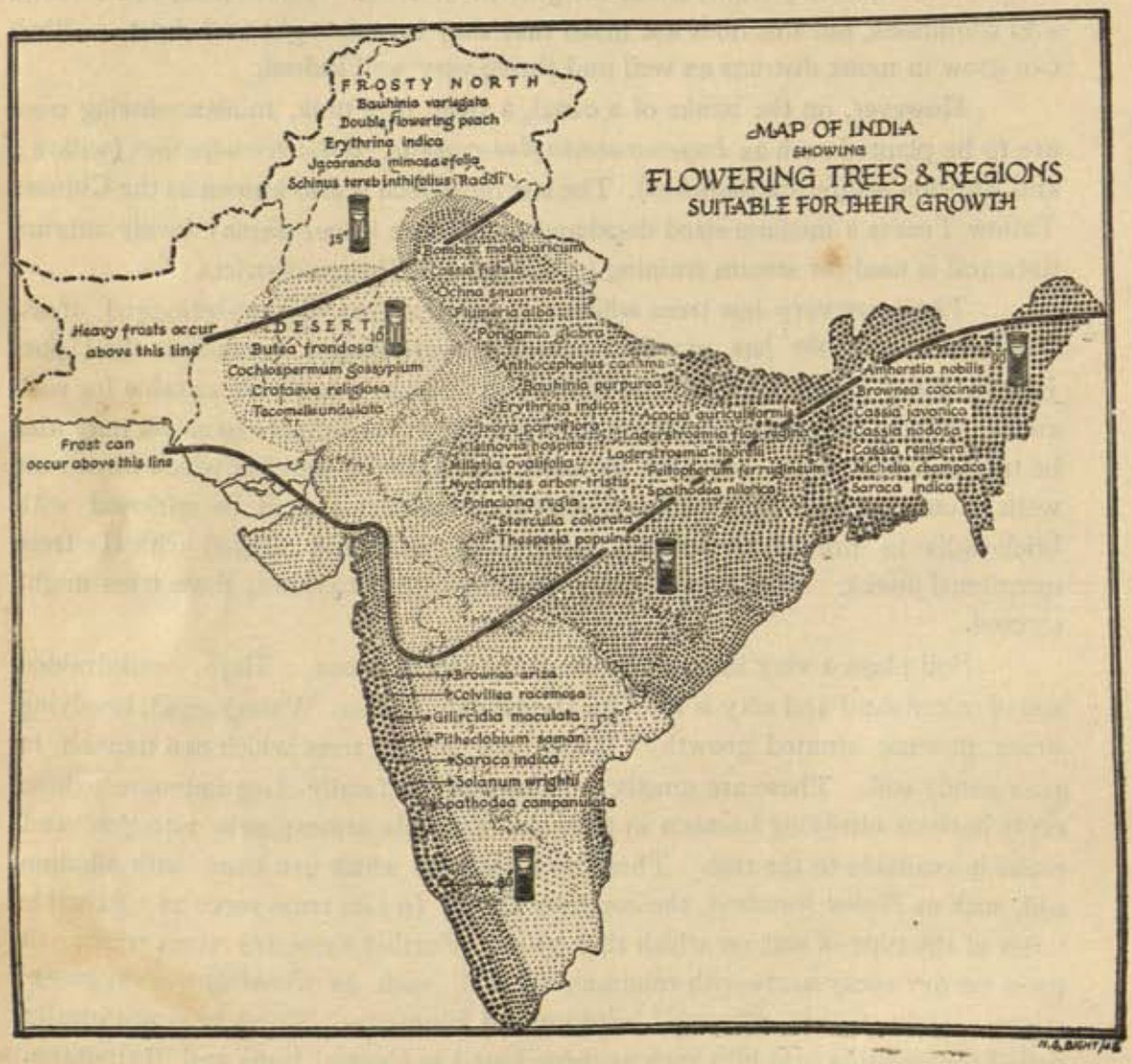
Soil

Soil plays a very important role in the life of trees. High, well-drained soil of mixed sand and clay is ideal for the growth of trees. Waterlogged, low-lying areas produce stunted growth. There are certain trees which can flourish in poor sandy soil. These are mostly members of the family Leguminosae whose roots harbour nitrifying bacteria in tubercles which fix atmospheric nitrogen and make it available to the tree. Then there are trees which can cope with alkaline soil, such as *Butea frondosa*, the common Dhak. In fact trees serve as a valuable index of the type of soil on which they grow. Further there are trees which can grow on dry rocky areas with minimum of soil, such as *Cochlospermum gossypium*, *Cassia fistula*, *Prosopis juliflora* and Plumerias. These trees are ideally suited for covering arid hills such as those found in Central India and Rajputana.

Animals, particularly goats, are the chief enemies of young trees. Some trees like *Cassia fistula* contain chemicals in their sap, and that is why goats, cows and buffaloes will not touch the leaves of Amaltas, which have a purgative action on their digestive organs. Hence Amaltas is well-suited for planting waste-land which cannot be protected from grazing animals.

Tropical trees and Frost line

Frost Line may be described as an imaginary line which passes through districts below which frosts never occur. Roughly this line extends from the sub-Himalayan districts of the United Provinces to the eastern districts of the Punjab. From our point of view the significance of this line lies in the fact that majority of the denizens of the equatorial and monsoon forests are unable to flourish in areas above this line. Given sufficient protection in winter they may grow in the area



above this line, but these trees are quite *unable to reproduce themselves* in areas where frost occurs. This explains why *Colvillea racemosa* produces so few seeds even in the United Provinces. Out of trees we have listed as suitable for moist localities, there are 12 trees which are natives of tropical countries like Africa, Madagascar, Java, West Indies, Malaya and Burma. These trees cannot be

satisfactorily grown in the Punjab, North-West Frontier Province, Kashmir and the Himalayan zone. In this matter the United Provinces of Agra and Oudh, Bihar, Bengal, Madras and Bombay provinces are more fortunate and the choice of trees available for planting is larger as compared with the northern area above the frost line. In these areas only indigenous trees which are adapted to our climate are indicated.

TABLE I

List of ornamental flowering trees suited for moist localities

Name of Tree	Country of origin	Time of flowering	Colour of flowers
1. *Amherstia nobilis*	Burma	March	Golden-yellow
2. *Bauhinia variegata*	India	March-April	White, pink or mauve
3. *B. purpurea*	West Indies	February-March	Red
4. *Brownea coccinea*	do.	do.	do.
5. *B. ariza*	do.	do.	Rose-pink
6. *Cassia marginata*	Ceylon	May-June	Terra-cotta red
7. *C. javanica*	Java	do.	Rose-pink
8. *C. nodosa*	Eastern Bengal & Malaya	do.	Bright-pink
9. *Cotvillea racemosa*	Madagascar	October-November	Scarlet-orange
10. *Guaiacum officinale*	West Indies	March-April	Blue
11. *Lagerstroemia flos-reginae*	Bengal	April-May and July-September	Mauve-purple
12. *L. thorelli*	India	do.	White-mauve
13. *Millettia auriculata*	Burma	March	Purple-mauve
14. *Poinciana regia*	Madagascar	April-June	Scarlet-orange
15. *Peltophorum ferrugineum*	Malaya	October	Golden-yellow
16. *Pithecolobium saman*	Brazil	March and September	Pale-pink
17. *Saraca indica*	India	February-March	Scarlet-orange
18. *Solanum wrightii*	Brazil	All the year round; particularly in October	White, and Purple-blue
19. *Spathodea campanulata*	Tropical Africa	February-March	Orange-red
20. *Sterculia colorata*	South India	April-May	

TABLE II

Ornamental flowering trees suited for dry localities

	Name of Tree	Country of origin	Time of flowering	Colour of flowers
1.	*Acacia auriculiformis*	Australia	October-November	Yellow
2.	*Butea frondosa*	India	March	Vermilion
3.	*Cassia fistula*	India	April-May	Yellow
4.	*Cordia sebestena*	South India	All the year round; particularly January to March	Scarlet-orange
5.	*Cochlospermum gossypium*	do.	March	Yellow
6.	*Erythrina indica*	India	February-March	Scarlet-red
7.	*E. Blackeii*	India	April	Cinnamon-red
8.	*Jacaranda mimosaefolia*	Brazil	March-April	Violet-blue
9.	*Melia azedarach*	Punjab (India)	April	Lilac
10.	*Plumeria alba*	South America	March-April, July-October	White
11.	*Pongamia glabra*	India	May	Mauve
12.	*Spathodea nilotica*	Tropical Africa	February-March	Orange-crimson
13.	*Tecomella undulata*	North India	March-April	Orange-yellow
14.	*Thespesia populnea*	India	All the year round; particulary in October and November	Yellow and reddish purple

TABLE III

List of drought-resistant trees suitable for arid regions

Albizzia lebbek — Siris. A deciduous, spreading, fast growing tree, 40 to 60 ft. high. Thrives in the Punjab, Rajputana and South Persia. Moderately drought-resistant.

Butea frondosa — Dhak or Palas. A medium-sized deciduous tree, gets covered in March with scarlet flowers. Extremely resistant to drought.

Cassia fistula — Amaltas. A medium-sized deciduous tree, 30 to 40 ft. high. Gets covered with golden yellow flowers in May.

Casuarina equisetifolia — *Beef-wood Tree.* A tall evergreen tree; 50 to 60 ft. high; with long needle-like leaves; native of Australia, grows well on dry sandy soil. Thrives in the Punjab.

Eucalyptus citriodora — Safeda. A tall evergreen tree; thrives in the Punjab and Iraq.

Melia azedarach — Persian Lilac, Dake, Bakain. Deciduous tree, 20 to 40 ft. high. Purple panicles in March. Flourishes in the Punjab.

Morus indica — Mulberry, Toot. Thrives in the Punjab, Syria and South Persia.

Phoenix dactylifera — Date-palm, Khajoor. Flourishes in Western Punjab, Persia and Iraq.

Prosopis juliflora — Mesquit Bean. A deciduous tree, medium sized, graceful feathery foliage. Of quick growth, extremely drought-resistant, a native of Mexico.

Salvadora persica — Pilu, Mustard Tree of Scripture. A small evergreen tree with small oval-fleshy leaves. Extremely drought-resistant, flourishes in Western Punjab and Persia.

TABLE IV

List of salt-resistant trees

Butea frondosa	Dhak, Palas. Extremely salt-resistant, in fact, the only tree which grows successfully on saline, *usar* and *kalar* soil.
Bassia latifolia	Mahua. Moderately salt-resistant, can grow on slightly saline soil. Yields good timber and edible fruit which can be fermented into liquor.
Eucalyptus citriodora	Moderately salt-resistant. Grows even in Iraq.
Azadirachta indica	Neem. Moderately salt-resistant.
Phoenix dactylifera	Date-palm, Khajoor. Flourishes in brackish soil.
Phyllanthus emblica	Amla. Flourishes in slightly saline soil.
Psidium guava	Guava. Can easily grow in mild *usar*.
Tamarix articulata	Farash. Thrives in arid saline soil.

TABLE V

List of trees for swamps and marshy areas

Eucalyptus rostrata	Has a high rate of transpiration and is useful for draining marshy areas.
Salix tetrasperma	Willow. Ideal tree for water-side planting.
S. babylonica	do.
Tamarix sp.	Farash. Can stand waterlogging.
Plantains	Kela. Its broad leaves have a high rate of transpiration.

TABLE VI

Nectar-yielding trees

1. *Bauhinia purpurea*
2. Bottle brush (*Callistemon lanceolatum*)
3. Horse Chestnut (*Aesculus indica*)
4. Jaman (*Eugenia jamboluna*)
5. Kachnar (*Bauhinia variegata*)
6. Neem (*Azadirachta indica*)
7. Sheeshum (*Dalbergia sissoo*)
8. Soapnut (*Sapindus*)
9. Tun (*Cedrela tuna*)
10. Barna (*Crataeva religiosa*)

TABLE VII

Fodder trees

Toot (*Morus alba*)
Kachnar (*Bauhinia variegata*)
Peepal (*Ficus religiosa*)
Neem (*Azadirachta indica*)
Babul (*Acacia arabica*)
Haldu (*Adina cordifolia*)

CHAPTER 9

Planting Trees and Their Care

IN North India we have typical wood-land climate which is favourable to the growth of trees. In wet districts with rainfall over 40 inches per annum and in comparatively drier districts where irrigation facilities in the form of canals are available a sapling grows into a fairly big tree in about six years. Most of the ornamental flowering trees produce flowers after a growth of four to five years. There is advantage in planting saplings one to two years old rather than raising trees from seed, especially in bare places where shade is quickly desired and a gain of one or two years' growth is of great value. Saplings over two years old are undesirable, as they take a long time to recover, especially when they are pot-grown with cramped roots.

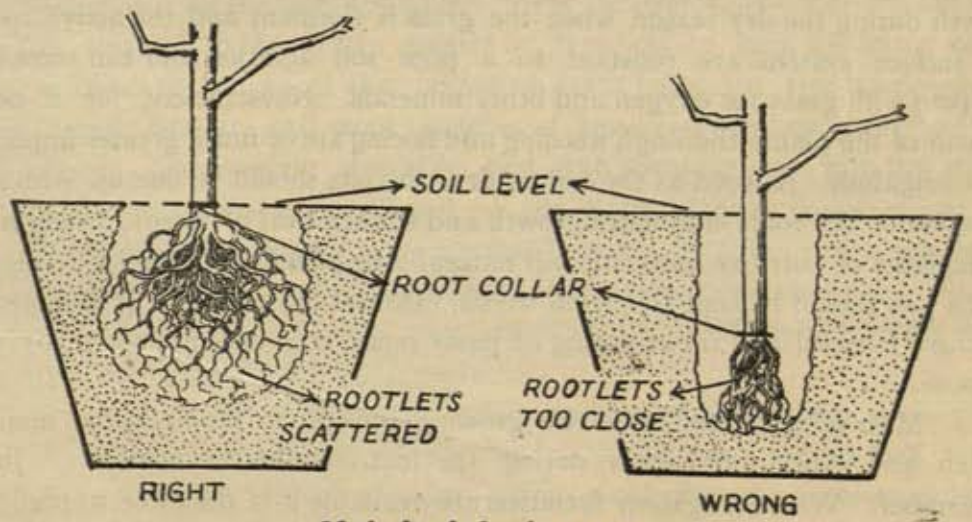
Preparing pits

Sites for pits should be planned and located beforehand, preferably three to four months before planting. There is a tendency to plant too many trees, as from the size of saplings people often fail to realize their eventual growth and the space they will occupy when mature. Dwarf trees should be grown 15 to 20 ft. apart, and larger trees when planted in an avenue or a clump should be at least 30 ft. apart. Pits at least 4 ft. deep and 4 ft. in diameter should be dug at the sites selected in the month of March. Expose the soil to the sun in the months of April and May, and in early June mix the soil with old farm-yard manure or compost in the ratio of 5 to 1. Mix them up thoroughly and fill the pit again with the mixture upto the ground level. Fresh or raw manure is not desirable as it is a standing invitation for white ants. Where the soil is unsuitable for the

growth of plants as in *usar* and *bhur* areas, it should be discarded and good soil from some other locality be used for filling the pits. When the soil in the pits has subsided after the first two or three showers of rain, the pits are ready for receiving the saplings.

Transplanting

The best time for planting trees is between January and February and in the monsoon months from July to September. Where irrigation facilities are available, winter is the best time for planting deciduous trees which shed leaves in that season. During winter they are in a dormant condition and are less likely to suffer damage when dug up. For evergreen and semi deciduous trees the rainy season is the best time for planting. Where irrigation facilities are available, it is preferable to plant trees in the last week of February, as the trees thus planted will be benefitted by spring growth and will be securely established by the time the rains come. In places where there are no irrigation facilities or the water supply is inadequate, planting should be done towards the end of July. If trees are planted in the month of February, the best time for planting is evening. During monsoons the planting should be done on a rainy or a cloudy day. After removing the plant from the pot its roots should be loosened and straightened. Injured portions of the roots and branches should be cut off. The root-collar should be just under ground-level and care should be taken to secure the same position for the sapling in the pit as the one it had in the nursery. It is injurious to plant too deep by burying the stem under ground. Do not remove or break the balls of soil attached to the roots. Make a hole in the pit sufficiently deep to receive the roots of the sapling. Place the plant in an erect position in the hole thus made and pack the soil tight round the plant. After planting give it a thorough drenching. These precautions are necessary for successful growth of the saplings, and where these are not observed, the transplants mostly die or remain stunted.



Methods of planting a tree

The practice of planting more than one sapling in a single hole in the hope that at least one of them will strike root is wasteful and undesirable. Saplings of one to two years' growth get established in the pits in a few days. If there are any casualties they should be replaced without much delay.

Weeding and hoeing

To understand the value of hoeing it is necessary to understand a few vital facts about the root-system of trees and related problems. Sir Albert Howard has made valuable observations on the root-system of fruit trees like guava, litchi and prunes. According to him most of the trees have a double root-system, a superficial root-system consisting of many freely branching roots running parallel to the surface and confined within 18 inches of the top soil as well as a deep root-system which grows vertically downwards and penetrates almost to the water table. During the hot months of March and April, the roots of the superficial system in deciduous trees pass into a dormant condition and turn brown, and the trees depend entirely on the deep root-system for its water requirements. In July, when the monsoon rains start and the surface soil becomes moist, the superficial root-system resumes its activity and many new rootlets are thrown out in all directions. These rootlets show aerotropic response till October.

Grass has a very harmful effect particularly on young trees and deciduous species suffer more than the evergreens. Fruit trees are practically suffocated by the growth of grass and their fruits become small and tough. During monsoon rains the volume of carbon dioxide in the spaces of soil under grass increases about five-fold as compared with the soil air of cultivated land. Carbon dioxide dissolves in the water film and the formation of humus, nitrification and mycorrhizal relationship are all affected. As compared with fruit trees like guava, litchi, loquat, forest trees like dhak, tamarind and jarul are able to compete with grasses and weeds on account of the fact that their deep root-system admits of growth during the dry season when the grass is dormant and the active roots of the surface system are resistant to a poor soil aeration and can successfully compete with grass for oxygen and other minerals. Nevertheless, for a healthy growth of the plants thorough weeding and hoeing are of much greater importance than irrigation. As soon as the soil is dry, the pits should be dug up with a hoe. Aeration of the roots stimulates growth and the removal of weeds, which rob the transplants of nutritive material, will naturally be beneficial. The entire diameter of the pits should be kept free from weeds. Do not dig wet soil. It is more likely to prove harmful and the churning of pasty liquid mud does not serve any useful purpose.

Irrigation

Most of our trees have two growing periods, in spring in the months of March and April and again during the monsoon in the months of July to September. Where irrigation facilities are available it is desirable to plant trees in the month of February after the end of the cold weather. Young plants

should be watered continuously from the month of March onwards, and particularly in the dry months of April, May and June, there should be at least five to six waterings a month. Each watering should be copious, so that water reaches the roots. Instead of a water-can the trees should be irrigated by flow through a channel and the pits should be filled to the brim. Grindal recommends the vertical insertion of earthenware flower-pots in the pits and pouring of water in these. Where watering is done by hand, this is a good method and it insures against superficial watering by the gardeners. Light surface sprinkling, even if it is repeated every alternate day, is actually harmful to the trees, for such superficial waterings tend to keep the roots of the tree near about the surface and the water cannot reach the sub-soil, thus resulting in slow and weak growth. On the other hand, if the watering is more thorough, the roots burrow deep down, thus resulting in a healthy growth of the tree. In the period between the waterings, the soil in the pits should be thoroughly hoed. The working of soil not only provides oxygen for respiration of the roots but also conserves moisture.

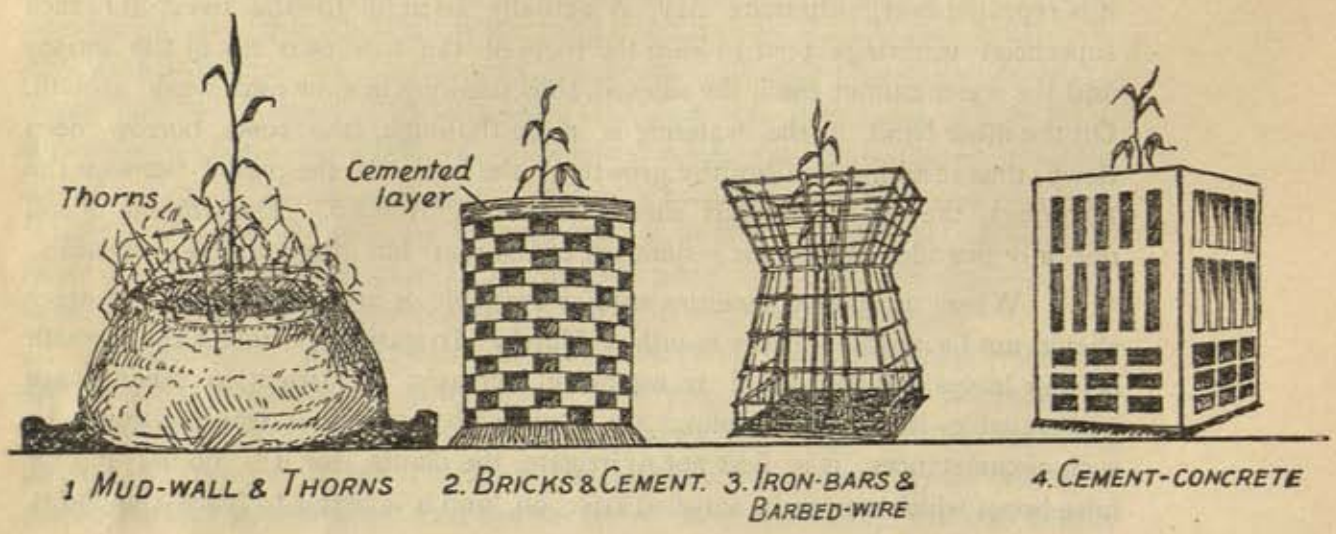
Where irrigation facilities are not available or are inadequate, the trees should not be irrigated in the month of March. Irrigation promotes the growth of new leaves and the rate of transpiration increases. If irrigation facilities are not available later on the saplings are damaged by excessive transpiration. In such circumstances, it is best not to irrigate the plants, for it is no use raising false hopes which cannot be satisfied later on, and it is better to leave the plants to their own resources.

Protection and pruning

In the second year, if the plant develops two or more shoots, it is better to retain only one healthy shoot and to remove the subsidiary ones. Pruning should be done with a pruning knife or saw, and to prevent infection, the open wounds should be tarred. As the tree grows the lower branches should be cut out and interlacing branches in the crown should be removed to keep the frame clear. Staking in the early stages is also necessary, as it helps the tree to develop a straight trunk. Straight and stout branches of trees and bamboo poles can be used as stakes. The sapling should be tied with plantain-fibre with the stake, and it is desirable to insert a small pad of old cloth between the plant and the stake. Strings or wire should on no account be used, as they injure the bark. Nails also should not be driven into the stem, as in some cases they even kill the trees and provide an open door for the attack of fungi. When the stakes have served their purpose, they should be removed.

The protection of young trees in the compound of a house is no great problem. But, in public parks and on the road-side it is a serious task. The main enemies of young trees are goats, cattle, monkeys and mischievous boys. The best solution is to provide tree-guards of bricks limed or cemented at the top,

so that bricks are not removed by thieves. Tree guards of bricks are suitable for public parks, town-roads and platforms of railway stations. Along the roads in the country-side, however, tree-guards of bricks are expensive and are a standing temptation to villagers and cartmen who remove bricks for making *chulahs* for cooking their meals. In such cases mud structure affords the cheapest and the best protection. The ditch around a mud structure serves as a useful barrier against cows and buffaloes but it is also necessary to place thorns on the mud-walls to ward off monkeys, boys and goats.



Tree-Guards

Training of grown-up trees

Pruning of some fruit trees is essential to keep their crowns in good shape, especially in the compounds of houses where the space available for the expansion of their crowns is limited. However, pruning should not be indulged in for its own sake. Every tree has its natural crown which is usually symmetrical and the necessity of pruning in the case of ornamental trees very rarely arises. But pruning is a necessity in the case of apples, pears, and other deciduous fruit trees. Many of the trees like amaltas, neem, and Putranjiva can stand quite drastic pruning and in some cases large growing trees can be headed back at 15 to 20 ft. In the case of quick-growing trees like jacarandas and gul mohurs it is more desirable to remove the tree altogether after 20 years and to plant afresh. Dead or diseased branches should always be sawn off.

Training of trees is also essential from the age of two to three years. By properly bending and tying young trees beautiful structures result, and glorietas and gate-ways of amaltas can be made and bottle-brush trees can be bent over tanks like weeping willows. Even trees with crooked branches like *Cassia nodosa* can be compelled to form a straight stem in a house with a limited space, if at the commencement the branches are thinned out, and the main stem is staked.

Nurseries

Development of an adequate number of nurseries is an essential preliminary step in the planning of the growth of ornamental, fruit and shade trees. At present the number of nurseries is very inadequate and a big programme of expansion with more staff should be undertaken and definite quotas should be fixed for each nursery so that sloth and indifference on the part of individuals may not stand in the way. There are nurseries at Delhi, Saharanpur, Lucknow, Allahabad and Agra connected with the Government gardens where a certain number of saplings of ornamental trees are grown. Considering the huge requirements of our bio-aesthetic plan for northern India, these nurseries are too small. The superintendents of these gardens complain that there is very little demand for ornamental trees and hence their small nurseries. At present this is understandable, for very few people have knowledge of the wealth of ornamental trees which we possess in this country, and we see the pitiable spectacle of jamuns, mahua and chilbil plantations in the compounds of houses in bungalows of canal and Public Works Department and other public places. Demand will be created by properly organized propaganda, and by diffusing knowledge about the selected ornamental trees in schools and colleges. When the average man is in need of a tree for planting, usually he gets hold of the nearest available, irrespective of the fact whether it is a neem or gul mohur. If he is advised as to what he should plant and at the same time provided with the plants at a moderate price, he will certainly show discrimination.

There is need for expansion of nurseries in our provincial capital towns and at the same time nurseries should also be developed at the headquarter towns of all districts in gardens owned by the municipal and district boards, and in the compounds of bungalows belonging to Public Works and canal Departments. The nurseries of district board and municipal board gardens should specialize in ornamental and fruit trees and those of Public Works Department and canal bungalows in ornamental, shade, and fruit trees; ornamental trees for the compounds of bungalows, shade trees for road-side avenues, and fruit trees for canal roads.

Mr. M. D. Chaturvedi, an experienced and imaginative forest officer, who may be regarded as one of the pioneers of bio-aesthetic planning in this country has given very helpful hints about raising nurseries in his pamphlet '*Road-side Avenues.*' It is very necessary that the inspecting officers should also know how to raise a successful nursery, so that this important work is not left to the whims of gardeners. Mr. Chaturvedi writes:

"*Site for Nursery:* Nurseries should be raised on the best available soil. Well-drained deep sandy loams are best suited for plant growth. Heavy clays should be avoided as far as possible. Posts for the erection of shades to protect

young seedlings from frost and desiccating sun should be permanently fixed around nursery beds.

Manuring : Thorough soil working and an occasional dose of organic manures, like cow-dung and vegetable litter, will result in good sturdy plants capable of standing transplanting shock with minimum wastage. Nursery beds should be about 5 ft. wide permitting the gardener to reach the middle from either side, and may be as long as necessary. A convenient size is 5 ft. by 25 ft. to hold 500 plants 6 in. apart. The long side of beds should run east-west for convenience of shading, if necessary.

Sowing of seeds : Seeds should be sown 6 inches apart and just covered with fine soil. Nurseries should be dead level, otherwise, seeds sown will tend to wash out on the lower end. Beds are to be carefully irrigated in the mornings in preference to evenings for the photosynthetic activity is at its highest at noon. Soil should be lightly worked after each irrigation.

Weeding : Nursery beds should be kept scrupulously clean of weeds, and the soil well worked up. It is not sufficiently realized that good weeding and soil aeration is as important as irrigation. The tendency to stress the importance of irrigation at the expense of weeding and soil working results in more weeds than plants.

Season : It is both convenient and cheaper to sow seeds in nursery beds at the break of the monsoon.

Transplanting : The seedling may be retained in the original seed beds till the following February when they should be dug out with a ball of earth and planted in another bed at a spacing of 2 ft. apart. These transplants should be irrigated right through the summer. At the break of the following monsoon they should be shifted again and put out 3 ft. apart. Seedlings pricked out twice under nursery conditions get accustomed to transplanting shock, and their root-system is prevented from becoming unwieldy. At the break of the third monsoon when the plants are two years old, they are ready for their roadside homes.

Transplants should be carefully dug out and, as far as possible, injury to the root-system should be avoided. An irrigation or two just before pricking out makes the soil soft and easy to work. Injured roots are best cut clean with a sharp knife. The ball of earth around each plant can be kept in place by a piece of gunny bag or straw tied round by a piece of string, and stitched where the lead is long. The gunny bag is to be kept moist during transit.

It is advisable to cut down transpiration during the transplanting period by reducing leaf surface. With the exception of leaves on the leading shoots all leaves may be snipped off with a sharp pair of scissors and not plucked anyhow.

Plants put out at the break of rains take a fortnight to three weeks to get established. A delay of two to three weeks may make all the difference between

success and failure. Most plants stop growth by the end of October and irrigation, where possible, must begin at the beginning of the following March to take full advantage of the growth in spring.

Protection against frost : The rigours of excessively frosty weather are very much reduced by a protective cover, irrigation and loosening of soil. Big and sturdy transplants usually manage to send in roots deep enough during the very first monsoon to bridge them over the following summer rendering irrigation unnecessary where not available."

CHAPTER 10

Celebrating Tree Planting Weeks

CONSIDERING the area of the country, the tree plantation plan which we have outlined is so gigantic that only a nation-wide effort can be expected to produce any results. Individual efforts, however zealous, cannot produce a visible effect. There is so much ugliness all about, that little patches of colour which an individual may produce are likely to be swamped in an ocean of ugliness. How should we set about this colossal task? There is a necessity of growing nurseries of flowering trees in all important towns. There is need of such nurseries in every town and every village of sufficient size and importance. When nurseries are established in Government, Municipal and Railway gardens, and in the compounds of dak bungalows, hostels, schools and panchayatghars in villages, and we have produced sufficient number of saplings, we can start the planting work by celebrating a 'tree-planting week' in the end of July, when rains have set in northern India.

While posted at Rae Bareli as deputy commissioner from 1941 to 1944 the present author initiated the celebration of such 'tree planting weeks'. All preliminary work was usually completed in the month of May. Sites for pits were selected in the compounds of public buildings such as collectorate office, district courts, municipal and district board buildings, tahsils, schools, platforms of railway stations, houses of leading land-owners and panchayatghars. The digging of pits, their manuring and filling was completed in the month of May,

Pagoda tree—" A growing tree is a living symbol of a progressing nation."

and indents for plants were collected from all departments and leading land-owners, and a collective order for supply of saplings was placed with the Superintendent of Government Gardens, Lucknow. Distribution of saplings and collection of bills was done through tahsildars. In the last week of July every year the tree planting week was inaugurated with great enthusiasm and all persons of importance participated. Co-operation was received from all departments, and particularly from the district board who control a net work of village schools dotted all over the country-side.

Tree Planting Week Delhi 1949

A very successful Tree Planting Week was celebrated in Delhi Province from 20th July to 27th July 1947. Never before in this country was such a festival held on so large a scale. Delhi gave an example to the towns and villages of India, as well as to other lands beyond the mountains and across the seas. Ministers, politicians, professors, city fathers, businessmen and other prominent citizens for a brief space downed pens and telephones, bank books and blue prints, and sallied forth with trowels to implant a green thought in a green shade. A tree planting plan had been drawn well in advance for all the important parks and gardens. The spacious park opposite Red Fort, Qudsia Gardens, Nicholson Park, Roshanara Gardens, Queens Garden, Ajmal Park and Lodhi Park were all planted with flowering trees.

A picturesque tree planting ceremony was carried out in the historic Purana Qila in which Pandit Jawaharlal Nehru, Sardar Vallabhbhai Patel and Shri Rajgopalachari and the Raja of Faridkot participated. At the entrance of the fort they were garlanded by small girls. On one side of the pits terraced platforms were prepared and decorated with earthen pitchers painted in blue and green in attractive patterns. A group of Bengali girls sang a melodious song. Pandit Jawaharlal Nehru, Sardar Vallabhbhai Patel and Shri Rajgopalachari planted kachnar trees. In his address Pandit Nehru said: "I think there should be a law about cutting down trees. A person who cuts down an aged tree should be required to plant another, and thus compensate for the loss." "A growing tree" he claimed, "is the living symbol of a progressing nation." These are the words which should be widely pondered. Pandit Nehru is a lover of trees, and gardening was one of his favourite hobbies during the long period of his incarceration in various jails. As head of the Government and as a lover of trees, the lead which he gave to the country proved fruitful.

A day was also set apart for ladies. Viscountess Mountbatten of Burma and Mrs. Sarojini Naidu followed by many other ladies planted kachnar trees in the grounds of the Qutb Minar park. The tree-planting ceremony was brightened by the folk dances arranged by Miss Nirmala Joshi and her troupe of dancers.

Commenting on the Delhi Tree Planting Week, Mahatma Gandhi said in one of his evening post-prayer speeches: "The official who originated the idea of tree-planting did not do it for fancy, nor was it meant for the monied men. It began with them so that others would copy them and thus add to the wealth and rainfall of India." Our main object in celebrating the Tree Planting Week at Delhi was to focus the attention of our people on the national importance of tree planting. In this we were successful. There was an unprecedented rush for saplings at the nurseries and tree planting was done in many provinces on an organized basis. Six years hence, the parks, gardens, hospitals, colleges and road-side avenues of the city of Delhi will be brightened with the clear strong gold and scarlets, the rich purples and blues and waxen whites of numerous flowering trees and they may tell Delhi children of to-day as they grow up the message of a minor nineteenth century poet:

"He that planteth a tree is the servant of God.
He provideth a kindness for many generations.
And faces that he hath not seen shall bless him."

Society of Friends of Trees

Griessen mentions the existence of a 'Society of the Friends of Trees' in Tunis, in French North Africa, whose function is to bring together all people who love trees and are interested in encouraging their planting. He states that packets of seeds of selected trees were supplied each year to the students of schools in Tunis, which were sown during a selected week. We should also organize such societies of lovers of trees to bring together people who are interested in the propagation of beautiful trees. Such a society ought to be organized under the auspices of the provincial Rural Development Departments. Seeds of kachnar, spathodea, amaltas, gul mohur, erythrina and other beautiful trees should be collected through the agency of the Horticultural Department and supplied to schools in pictorial packets containing a description of the tree with directions about planting. When the school work is inspected, the inspector should see that the school teachers take sufficient interest, and those who show good work are encouraged by grant of certificates, sanads, cash prizes and good entries in their character rolls. It need hardly be emphasized that all manual work such as digging of pits, manuring, and irrigation should be done by the students and teachers rather than by hired labourers. Spades and *hoes* should be provided to all schools at government expense, and persian wheels should also be fitted on wells where the water level is suitable.

A 'Tree Planting Week' need not necessarily be confined to the planting of flowering trees only, though it should form an integral part. Planting of timber trees like tamarind, neem, bakain, shisham and babul on waste land, and of fruit trees like lemons, sweet lime, papaya, amlas, kathal, mangoes and bananas in gardens in the back part of compounds of houses should also form

part of the programme. Thus we will be increasing the wealth of the country by planting timber trees, and improving the health of the people by providing them with vitamins in their dietary by planting fruit trees, and will be elevating their souls and developing aesthetic consciousness by planting beautiful flowering trees.

CHAPTER 11

Planting Trees in Villages

GREAT opportunities exist in the villages of India for planting fruit, timber and fuel trees for the use of the villagers. Fuel and timber trees can be grown in village pasture lands and cattle sheds and fruit and ornamental trees in the compounds of houses, village schools, mosques, temples and *Gurdwaras*, boundaries of fields and bullock runs of wells fitted with persian wheels. To push forward a programme of tree planting there is need of propaganda on an extensive scale and of nurseries for supplying plants to the villagers. Needless to say that facilities in the form of readily available plants from nurseries raised for the purpose at district and tahsil headquarters and panchayatghars in villages are more important than mere propaganda.

A comprehensive tree plantation programme for villages would include renovation of existing orchards, planting new orchards, individual planting of fruit trees like mangoes, lemons, sweet limes, guavas, papayas, kathal and bananas in the compounds of houses of farmers or in the form of shelter belts in farms where the fields are consolidated in blocks. It would also include raising of fuel plantations on waste lands which are commonly used for pasturing cattle.

Consolidation of scattered and fragmented holdings will greatly help in pushing forward tree plantation programmes in the villages. When scattered fields are brought together, homesteads similar to those in Europe can easily

Golden yellow flowers appear on the yellow silk Cotton Tree when it is leafless in March.

develop. The farmer with his family and livestock will live on the land and the problem of insanitary villages and inefficient cultivation will also vanish.

Man, animal, tree and soil

The pattern of farming, which may suit the needs of teeming peasant population of the Indo-Gangetic alluvial plains of India, may be described as mixed farming, practised on an individual basis by farmers on consolidated blocks of land. Mixed farming may be described as commensalism, in which man, animal, tree and soil are linked together to their mutual advantage. Irrigated soil provides crops and trees for the benefit of man and the animal and they, in their turn, fertilize the soil by providing manure. Under such a pattern of farming, each family keeps a couple of buffaloes or cows, some poultry, grows a patch of vegetables, crops, and fruit trees along the edges of the farm for use as well as sale. In wet areas, fish culture may also be done in a small tank in the farm.

Plantation scheme

For a homestead in moderately wet areas an ideal plantation scheme would be like this:

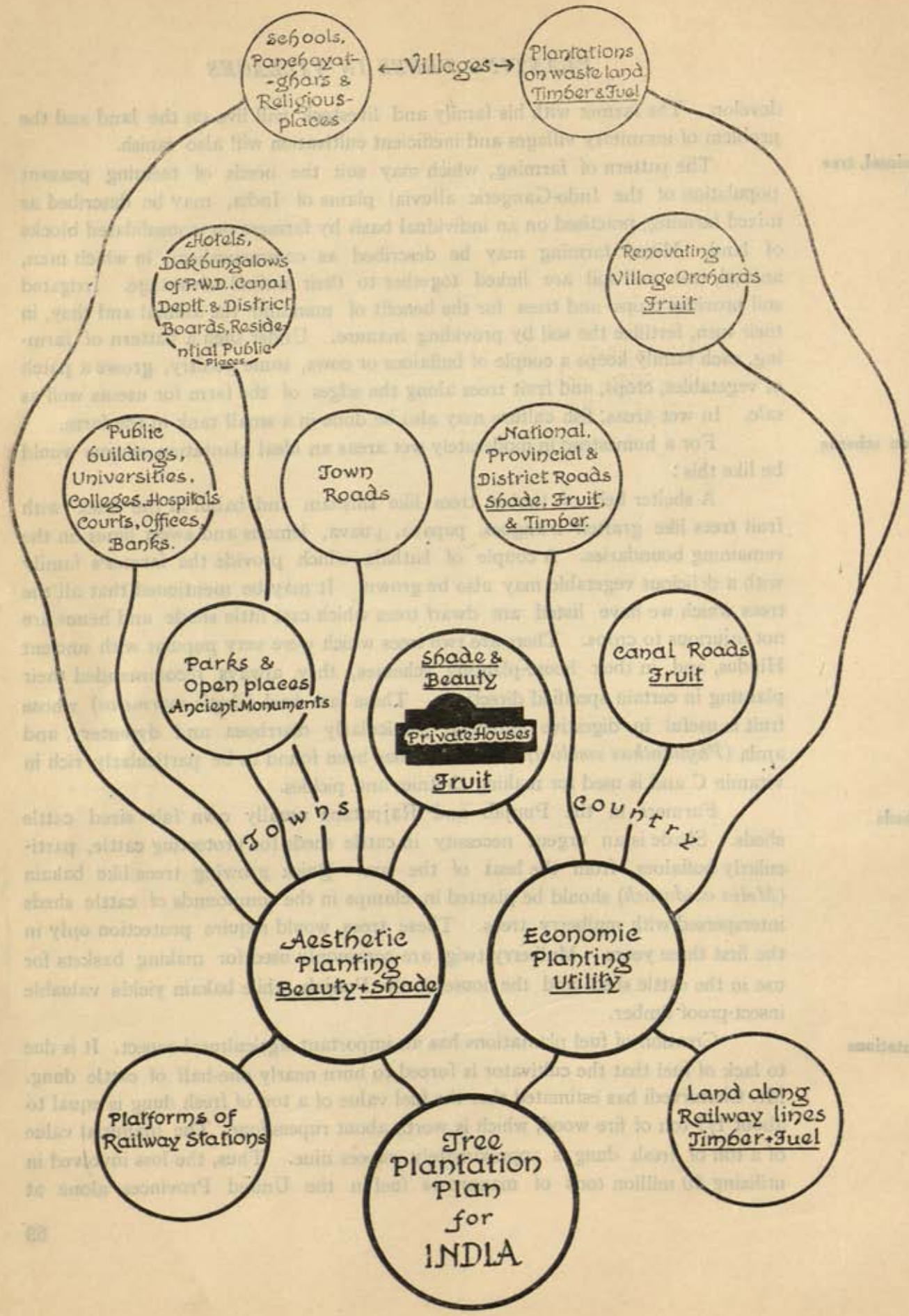
A shelter belt of timber trees like shisham and babul at the back with fruit trees like grafted mangoes, papaya, guava, lemons and sweet limes on the remaining boundaries. A couple of kathals which provide the farmer's family with a delicious vegetable may also be grown. It may be mentioned that all the trees which we have listed are dwarf trees which cast little shade and hence are not injurious to crops. There are two trees which were very popular with ancient Hindus, and in their house-planting schemes, they always recommended their planting in certain specified directions. These are bael (*Aegle marmelos*) whose fruit is useful in digestive ailments, particularly diarrhoea and dysentery, and amla (*Phyllanthus emblica*) whose fruit has been found to be particularly rich in vitamin C and is used for making chutnies and pickles.

Cattle sheds

Farmers in the Punjab and Rajputana usually own fair sized cattle sheds. Shade is an urgent necessity in cattle sheds for protecting cattle, particularly buffaloes, from the heat of the sun. Quick growing trees like bakain (*Melia azedarach*) should be planted in clumps in the compounds of cattle sheds interspersed with mulberry trees. These trees would require protection only in the first three years. Mulberry twigs are commonly used for making baskets for use in the cattle shed and the house in the Punjab, while bakain yields valuable insect-proof timber.

Fuel plantations

Creation of fuel plantations has an important agricultural aspect. It is due to lack of fuel that the cultivator is forced to burn nearly one-half of cattle dung. Mr. Chaturvedi has estimated that the fuel value of a ton of fresh dung is equal to about 1/5 ton of fire wood, which is worth about rupees four. The manurial value of a ton of fresh dung is approximately rupees nine. Thus, the loss involved in utilizing 50 million tons of manure as fuel in the United Provinces alone at


Schools, Panchayat-ghars & Religious-places
←Villages→
Plantations on waste land Timber & Fuel
Hotels, Dak bungalows of P.W.D. Canal Deptt. & District Boards, Residential Public Places
Renovating Village Orchards Fruit
Public buildings, Universities, Colleges, Hospitals Courts, Offices, Banks.
Town Roads
National, Provincial & District Roads Shade, Fruit, & Timber.
Parks & Open places Ancient Monuments
Shade & Beauty
Private Houses
Fruit
Canal Roads Fruit
Towns
Country
Aesthetic Planting Beauty + Shade
Economic Planting Utility
Platforms of Railway Stations
Tree Plantation Plan for INDIA
Land along Railway lines Timber + Fuel

rupees five per ton, amounts to 250 million rupees. If fuel plantations are raised, cow dung will be utilized for manurial purposes, and such plantations will also arrest wind and water erosion of soil.

Village *shamilat*, the common land which is used for pasturing cattle, is ideal for village plantations. Old fallow land which has been out of cultivation for a long time can also be planted with trees. The question is whether these plantations should be raised and managed by individual farmers or by the village panchayats. Plantation, under the supervision of the panchayat and common ownership of the trees is an ideal solution, but the difficulty lies in the lack of corporate sense in many villages. Usually we find that everyone's responsibility is no one's responsibility, and trees planted with great effort are grazed by cattle. So we have to adopt both the remedies. In a village, where a panchayat is functioning successfully the plantation should be raised by the panchayat, which can also appoint village young men as guards for protecting the trees in the first two years.

In the *zamindari* and *taluqdari* villages of Oudh the waste land belongs to the zamindar or the taluqdar and not to the cultivators. This is the biggest obstacle in the way of tree plantation programmes in these villages. The tenants cannot be expected to plant trees for the benefit of zamindars and the zamindars are either too lazy to take up the plantation work themselves or the area of waste land under their control is too vast and scattered to be planted by them successfully. To overcome this difficulty in the way of progress, the proprietary rights in the waste lands must be given to the village panchayats.

Individual plantations

In some villages it would be more feasible to partition the village waste land into allotments. These allotments should be enclosed by *kutcha* walls to give protection to young trees. Where water table is fairly high a *kutcha* well may also be dug in the plot. Near the boundary wall thorny fuel trees like babul or mesquite and in the middle area, fruit trees like *desi* mango and kathal may be planted. The fruit trees may occupy 25 per cent of the area and the remaining should be covered by fuel and timber trees.

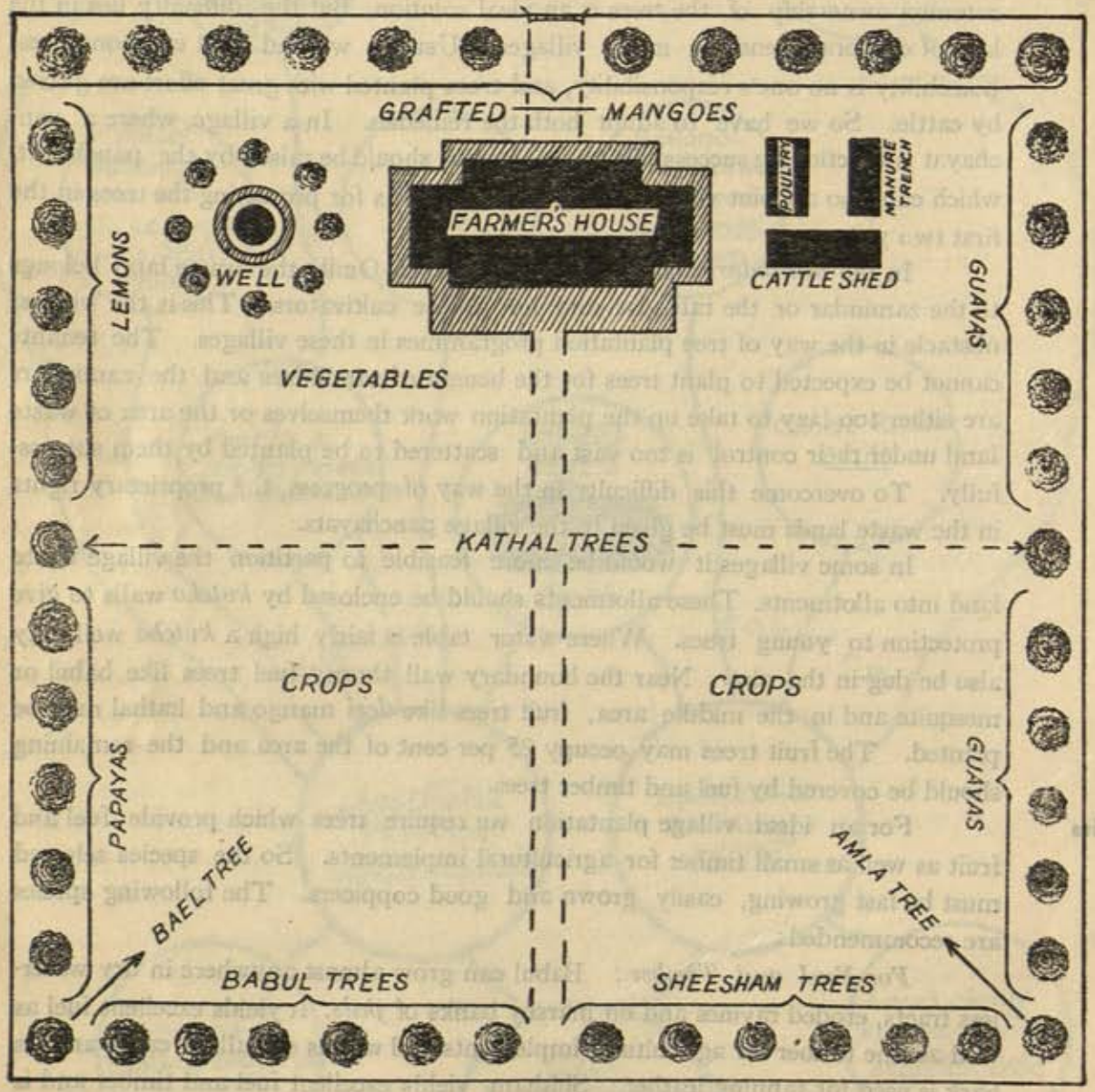
Choice of species

For an ideal village plantation we require trees which provide fuel and fruit as well as small timber for agricultural implements. So the species selected must be fast growing, easily grown and good coppicers. The following species are recommended :

For Fuel and Timber : Babul can grow almost anywhere in dry waterless tracts, eroded ravines and on marshy banks of *jhils*. It yields excellent fuel as well as fine timber for agricultural implements and wheels of bullock carts, and its bark is used for tanning leather. Shisham yields excellent fuel and timber and is fast growing. It has been used extensively for covering sand-covered fields along the

banks of *chos* in Hoshiarpur district and is a good coppicer. Bakain is a very fast growing tree and yields insect-proof timber for ploughs. Mesquite can easily grow in sandy and rocky soil. Dhak will grow on the worst soil and can even tolerate mild *usar*. It is a good coppicer. Bamboos can easily be planted near ponds. Bamboo has many uses in the farm. In case of mulberry only *desi toot* should be encouraged.

Desi Fruit Trees: Good varieties of *desi* mangoes with thin juice and good flavour and stones of grafted varieties like Safeda, Duseri and Langra,



A Tree Planting Scheme for a Farmer's homestead

should be selected and grown. In areas with rainfall over 30 inches kathal trees should be encouraged. Mahua is a popular tree in Oudh and is valued for its fruit as well as wood. It can grow on mild *usar*. Jamun variety with big-size fruit, known as Ra-jamun should be encouraged. This is one of the few trees which can stand waterlogging and can be grown on areas liable to be flooded. Tamarind yields edible fruit as well as excellent coal for producer-gas engines.

Fodder trees

Fodder trees provide valuable cattle feed in winter months when grasses are not available. As compared to grasses, some leaf fodders, particularly those of kachnar and toot are exceptionally rich in essential nutrients as crude fats and proteins, lime and nitrogen-free extractives. The best leaf fodder species are kachnar, toot, neem and babul. Fodder trees also deserve to be grown in village plantations.

Tree crops

The Forest tree Relation Department of the TVA have developed an unusual line of research which concerns the development of the so-called tree crops. Elaborate experiments were conducted to discover suitable trees and shrubs which will yield crops of fruits or nuts, which are either directly available for human consumption or can be fed to pigs or other livestock. Incidentally the bird population also multiplies. Black walnut, filberts and sumachs have proved a success. A very large experimental arboretum is maintained as well as several hundred demonstration farms, for work of this nature.

In India the subject of tree crops deserves attention by the Forest Department. Tree crops can be encouraged in Government forests as well as in private village forests. Wild fruit trees like ber (*Zizyphus jujuba*) and toot (*Morus alba*) can be propagated on waste land and forests on a big scale. Ber provides a delicious fruit of many varieties which is eaten both in fresh and dried condition. It is also an excellent fodder tree and its leaves are fed to goats and buffaloes. It is an extremely hardy tree which can stand drought as well as frost and is ideal for barren districts with comparatively poor rainfall. Ber also provides a valuable famine food. By selection and hybridization, the fruit can be improved in size as well as in taste.

CHAPTER 12

Planning Your Home Garden

GARDENING like music is one of the most sensitive of fine arts. A landscape designer should be an artist, an aesthete, a botanist, a gardener and an architect. As an artist he should have an eye for colour and form, and as an aesthete, love for nature and beautiful plants. He should also know the anatomy, physiology and ecology of plants, as well as the principles of sculpture, architecture and engineering to appreciate the relationship of plant form and architecture. He should select not only plants which are suitable for the soil, but he should also possess a highly trained aesthetic sense so that he is able to appreciate the principles of balance, rhythm and accent in planting of trees.

Beauty and utility

Beauty and utility should be harmoniously combined, and we must give up the idea that to be useful a thing must be ugly, and an object is useless because it is beautiful. Beauty and utility were at opposite poles a century ago when expensiveness and ornamentation were the chief canons of beauty, and it was thought necessary that a chair or a table must be expensively carved to be beautiful. Now we appreciate that a piece of furniture or crockery can be simple in design and yet beautiful. The ideals of utility and beauty have coincided. Now we realize that whatever is to be designed must perform its function easily, thoroughly and gracefully. In fact all true beauty is functional. The body of a well-developed woman is beautiful because it expresses its function of procreation and maintenance of the species so well. A tea-pot is beautiful when it can contain

Asoka Tree is associated with young and beautiful woman and the tree was supposed to flower when its roots were pressed by the foot of a charming young girl.

sufficient amount of hot water and pour it out in a steady stream. A tea-pot from which hot water trickles out drop by drop or in a torrent cannot be called beautiful. Similarly a garden in which trees of all varieties are jumbled together without regard to the colour of flowers, the shape of crowns and the height of plants cannot be called beautiful. A garden is a place for repose and quiet contemplation of beauty and, if its design is such that one experiences a sense of irritation, it is badly designed.

In garden design one has to see that a tree is placed properly and that the right tree is selected. If a cheap oleograph of Ravi Varma showing Shiva with serpents coiled around his neck is placed in a sitting room, it will make no difference against which window it is hung for it will look equally hideous in all shades of light. If one possesses a Himalayan landscape of Bireswar Sen, Brewster or Roerich showing the steel grey Himalayan snows after sunset, or inimitable lonely mystical figures in the mellow star light, one has to be careful where it is placed. If it is hung in a heavily curtained dark sitting room, or opposite a door where light reflects from the glass of the frame, it is decidedly out of place. So you have to select your picture as well as to select the place in your house to display it. Similarly, you have to select your tree, and also its site. If a dwarf kachnar is placed behind a tall *Colvillea*, it is bad design. Design thus deals as much with the placing of the object as with the object itself.

Tree form and topography

Roote and Kelly have defined landscape design as the 'satisfactory and consequently beautiful composition of natural areas—shape of earth, trees, and sky —in three dimensions'. Tree form shows remarkable adaptation to topography. We usually find that the shapes of the crowns of trees which grow in a particular locality are adapted to the landscape. Thus the twisted cryptomerias of Japan grow on irregular volcanic rocks, the elongated conifers like the pine, deodar, cypress and fir with columnar stems and elongated-globose crowns harmonize with pyramidal mountains of the Himalayas, the semi-globose oaks, chestnuts, maples and apples go so well with the rolling downs and small hillocks of England and France. On the other hand, umbrella-like acacias and gul mohurs and semi-umbrella-like neems, mahuas, mangoes, banyans and peepals of the alluvial plains of Northern India are admirably suited to the flat nature of the country. Contrast with these the grotesquely twisted trees of the Vindhyas which grow on inhospitable rocks. The modification of tree shape and crown is possibly related to light. I have seen columnar pine-like peepal trees in congested gardens. A tree with an umbrella or a semi-umbrella-like crown assumes its natural shape when plenty of space is available for the spreading of branches. The linear habit of the conifers is so well-adapted to crowding on a hill-side. Possibly, it originated as a mutation and the resemblance of pyramidal or linear crowns of the conifers to pyrami-

dal mountains is fortuitous. That this peculiar habit is chromosomal in origin is proved by the fact that these trees retain their linear shape even in the plains where there is no crowding in growth and no struggle for light is imposed.

It has been found that a tree from one particular habitat when grown in a different habitat serves as an accent material. Thus a cypress, a pine, a deodar, or a Lombardy poplar when grown in the plains serves as a most striking accent.

Accent : According to Roote and Kelly ' Accent is attained by the use of a plant the distinguishing characteristics of which are quite noticeably different from those of the plants which form its setting'. Thus accent may be secured by planting trees and shrubs of a different scale and form than those growing in the locality. A solitary date palm, a *Polyalthia*, a poplar, a *Millingtonia*, a pine, a cypress, a deodar, or an *Araucaria* growing in the corner of a lawn serves as an accent material when the other trees and shrubs are low and rounded. Accent may also be produced by using trees with unusual foliage or brilliantly coloured flowers. Thus a solitary *Colvillea* or gul mohur serves as an accent material. Accent material should be used sparingly ; a mass of tall and unusual trees all clamouring for attention produces a confusion, and a loss of unity occurs.

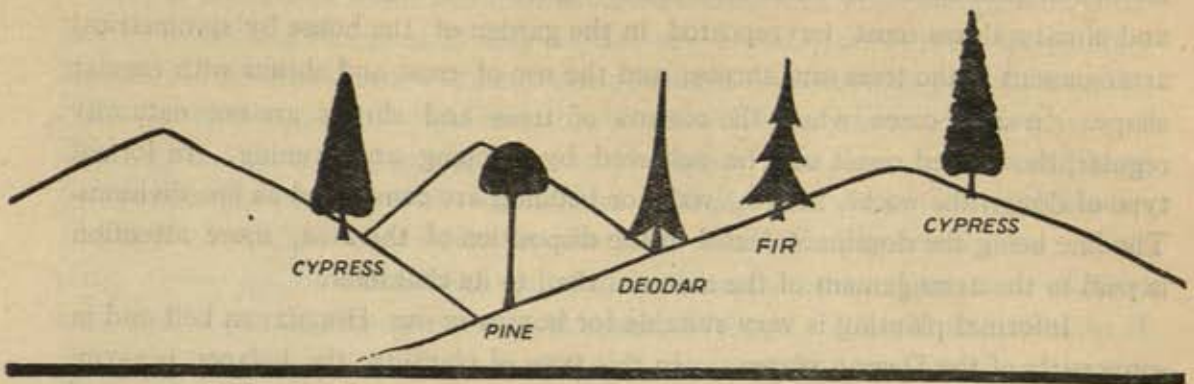
Formal and informal planting

If a person is asked as to what type of planting scheme he would prefer for his house, formal or informal, you will find that, if he is progressively minded, he would invariably go in for an informal design. It is here that a word of caution is necessary. The words ' formal ' and ' informal ' when used in relation to planting should be taken out of their social or political context.

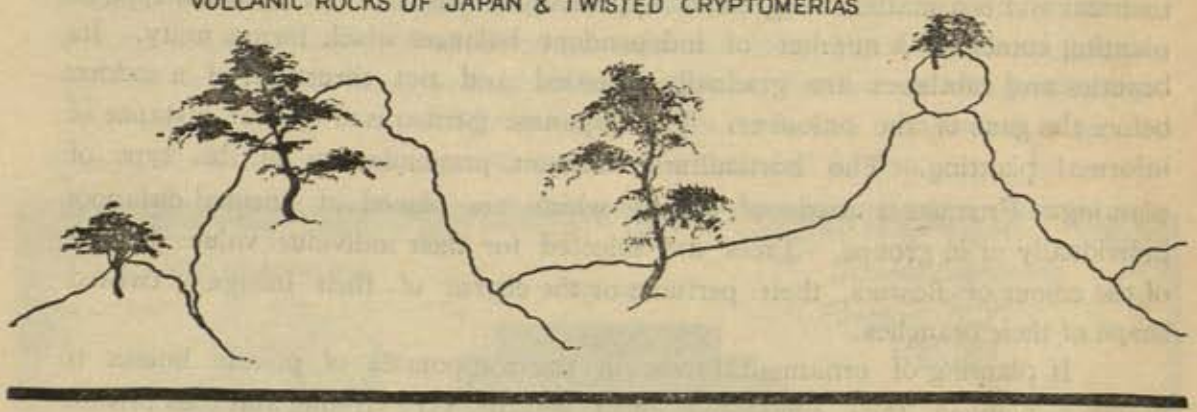
Informal planting is suitable for uneven ground and formal planting for flat ground. As Roote and Kelly have defined, ' Informal design may be called a study of space relations, and formal design a study of lines. Informal planting consists of irregular forms irregularly placed, and formal planting consists always of regular forms regularly placed. In a formal scheme straight lines and angles are emphasized on account of their greater precision, while the informal type lays larger emphasis upon curves and rounded masses. In the formal type little is left to the imagination, few unexpected arrangements occur, and the whole scheme is visible from one point, instead of unfolding gradually to the view'.

Formal planting is based on geometrical balance, and informal planting on occult or unsymmetrical balance. Formal arrangement is usually based on bilateral symmetry and use of trees with regular and symmetrical crowns. Moghul gardens with their rows of cypresses are a typical example of formal planting. Formal planting is always used in connection with architecture. It is the architectural element which predominates and the trees used repeat the character of the lines of the building. Mark the resemblance of cypress trees grown in the Taj Mahal with the four columnar towers. Formal planting is particularly suitable

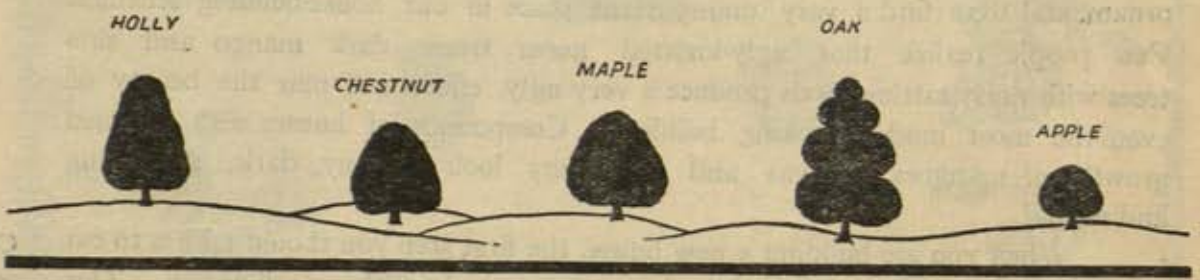
PYRAMIDAL MOUNTAINS OF HIMALAYAS & TREES WITH ELONGATED-GLOBOSE CROWNS



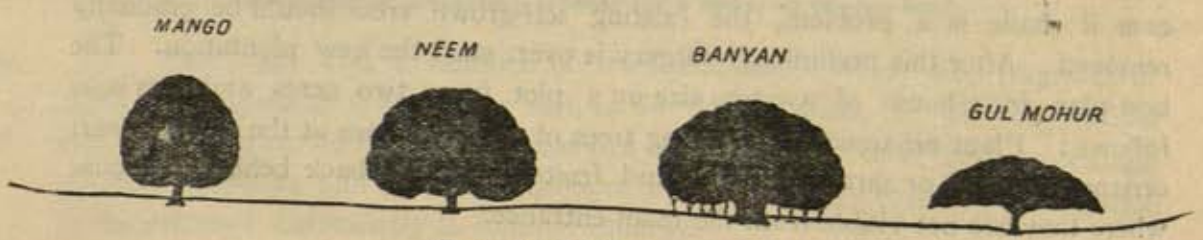
VOLCANIC ROCKS OF JAPAN & TWISTED CRYPTOMERIAS



ROLLING DOWNS OF ENGLAND & SEMIGLOBOSE CROWN OF TREES



FLAT PLAINS OF NORTHERN INDIA & TREES WITH UMBRELLA OR A SUB-UMBRELLA-LIKE CROWN



Tree shape and topography

for buildings in cities. In cities lines are straight or rectangular and their primness and unnaturalness must be repeated in the garden of the house by symmetrical arrangement of the trees and shrubs, and the use of trees and shrubs with regular shape. In some cases where the crowns of trees and shrubs are not naturally regular, the desired result can be achieved by clipping and pruning. In formal type of design the walks, hedges, walls or bedding are considered as line-divisions. The line being the dominant factor in the disposition of the area, more attention is paid to the arrangement of the material than to its character.

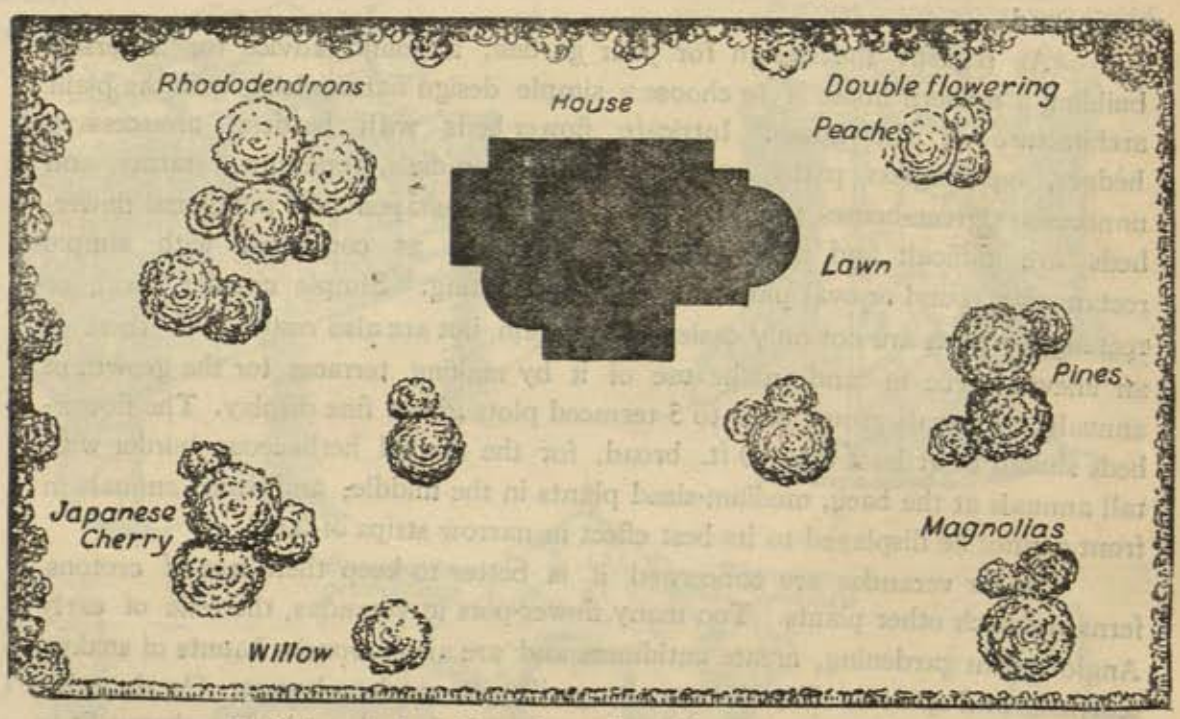
Informal planting is very suitable for houses in our Himalayan belt and in some parts of the Deccan plateau. In this type of planting, the balance is asymmetrical and is a matter of gradual appreciation. In fact an informal type of planting combines a number of independent balances which form a unity. Its beauties and subtleties are gradually unfolded and not thrust all of a sudden before the gaze of the onlooker. The Japanese garden is a typical instance of informal planting. The horticultural element preponderates in this type of planting. Free use is made of shrubs which are placed at unequal distances individually or in groups. Trees are selected for their individual value—beauty of the colour of flowers, their perfume or the charm of their foliage or twisted shape of their branches.

If planting of ornamental trees in the compounds of private houses is properly planned, their cumulative effect will be very striking and thus private individuals can create an artistic environment for their families and also add to the beauty of the town which has claims on them as its citizens. Unfortunately ornamental trees find a very unimportant place in our house-building schemes. Few people realize that ugly-knotted neem trees, dark mango and siris trees with noisy rattling pods produce a very ugly effect and mar the beauty of even the most modern-looking building. Compounds of houses with crowded growth of mangoes, guavas and jack-fruits look gloomy, dark, depressing and dismal.

Compounds of private houses

When you are building a new house, the first step you should take is to cut all existing siris, mahua, babul and other trees, most of which are self-grown. This may appear painful especially when mature trees are concerned, but it is a necessity, for no planning is possible unless the existing confusion is cleared. In any case if shade is a problem, the existing self-grown trees should be gradually removed. After this preliminary surgery is over, start the new plantation. The best plan for a house of average size on a plot from two acres and less is as follows: Plant ornamental flowering trees of medium size at the sides, dwarf ornamental trees or shrubs in front, and fruit trees at the back behind the house where they are not visible from the main entrance.

In the case of small and medium-sized houses with small compounds, ornamental trees should be planted *only on the outer boundaries.* It is no use planting avenues on the inner roads in a small compound, for such avenues produce a stifling effect and the compound appears narrower still. If you have about two acres of land then have a double row of trees at the sides; the outer row should be of ever-green shade trees with ornamental foliage, like *Acacia auriculiformis*, *Polyalthia longifolia*, *Putranjiva roxburghii*, or *Phyllanthus emblican*. Have a row of one species on one side and of another on the other. First three of these trees have a compact linear crown and beautiful foliage. Planted at a distance of 15 ft. they produce a beautiful screen which also serves as a background for the flowers of ornamental flowering trees which should be put in the second inner row at a distance of about eight feet from the outer row (Fig. 3). Only dwarf flowering trees which are listed separately should be grown, for it is no use putting big trees with spreading umbrella-like crowns like gul mohurs in compounds of small houses where adequate space is not available for their full growth.



An informal plantation scheme for a house on uneven land

Trees with fragrant flowers

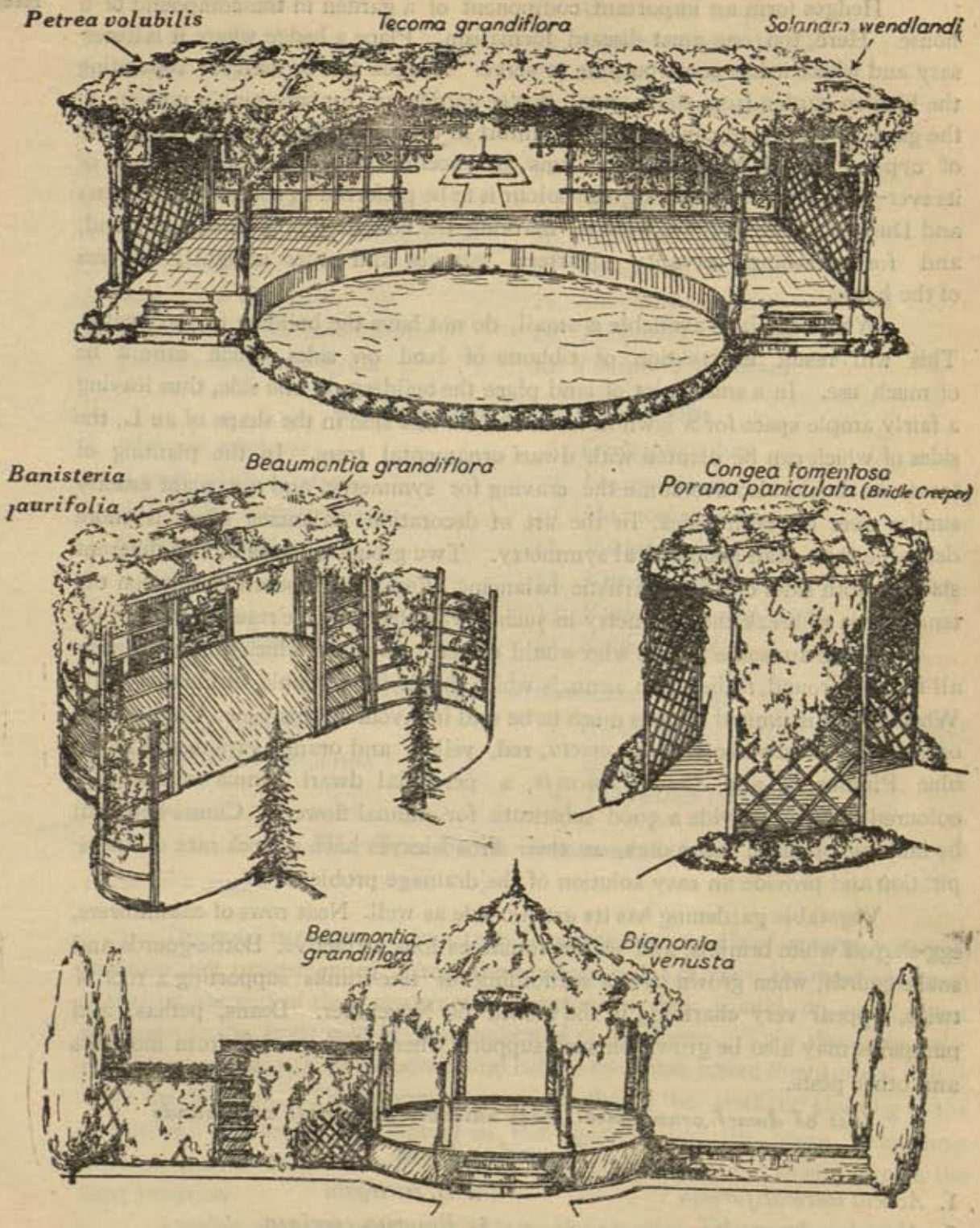
There are also a number of trees and shrubs which emit fragrance at night time, especially during rains, such as *Gardenia lucida*, *G. florida*, *G. latifolia* and *Cestrum nocturnum*. These can be planted to their best advantage opposite windows and doors of bedrooms, so that one may enjoy their fragrance in the evenings, particularly in summer months.

Planning the garden in your compound

While planning your ideal home, do not forget to pay a proportionate attention to the layout of your compound. The house and the garden should be designed as a unit, and one should consider how the garden will look from the house, and how the house will appear from the garden. The garden provides a background and setting to the house, as a frame to a picture. The view of the garden from the house is very important and there should be something pleasant and colourful to look at from every door, window and verandah. Facing the verandah beyond the open lawn, one may plant pink cassia, amaltas, peltophorum, jacarandas, or bauhinias which all flower from March to June, the hot months in which we sit in the verandas of our houses. However, do not smother the house in trees. The trees should be restricted to the boundary wall and corners of the plot, and have a level, quiet and restful lawn in front of the house. In a small plot of land a feeling of spaciousness is given by a foreground of lawn, and if trees are planted too near the house, the result is stifling confusion and narrowing of the compound.

As regards the design for your garden, a sound advice for a person building a modern house is to choose a simple design harmonizing with the plain architecture of the house. Intricate flower-beds with borders, unnecessary hedges, meaningless paths, useless pergolas, sun-dials, fountains, statues, and unnecessary green-houses should be avoided. Star-shaped and polygonal flower-beds are difficult and more costly to maintain as compared with simple rectangular, round or oval plots and appear irritating. Simple circular, oval, or rectangular plots are not only easier to maintain, but are also restful. If there is an uneven piece of land, make use of it by making terraces for the growth of annuals. Annuals grown on 4 to 5 terraced plots give a fine display. The flower-beds should be at least 6 to 10 ft. broad, for the annual herbaceous border with tall annuals at the back, medium-sized plants in the middle, and dwarf annuals in front cannot be displayed to its best effect in narrow strips of land.

So far verandas are concerned it is better to keep them free of crotons, ferns and such other plants. Too many flower-pots in verandas, the relic of early Anglo-Indian gardening, create untidiness and are also favourite haunts of snakes, scorpions and spiders. Fern-houses also go ill with modern houses. On the other hand cacti with their peculiar globular, cylindrical and snake-like shapes fit in admirably with modern architecture and a rock-garden with an assorted collection of cacti is an asset to a modern house. Lantanas, Hazara Orange, Petraea and Bougainvilleas grown in standards also add a good deal of charm to a compound. Do not have too many of these, a few plants judiciously placed at appropriate places produce a far more pleasing effect than a jumble of plants. Simplicity of treatment and design is the key-note of a modern garden.



Different types of pergolas with suitable creepers

Hedges

Hedges form an important component of a garden in the compound of a house. Here, too, one must discard formalism. Place a hedge where it is necessary and where it has some purpose to serve. Hedges can be used for separating the kitchen garden from the annual flower garden or for screening a portion of the garden where one can recline in comfort in the sun during winter. A variety of cypress called Mor Pankhi forms an excellent hedge, and on account of its ever-green nature and dark-green colour is to be preferred to common Dodoneas and Durantas. Hedges are used for marking the boundaries of the compound, and for screening servants' quarters, garages and other unsightly features of the house.

Where the land available is small, do not have the building in the centre. This will result in creation of ribbons of land on sides which cannot be of much use. In a small plot of land place the building on one side, thus leaving a fairly ample space for a lawn in front and on one side in the shape of an L, the sides of which can be planted with dwarf ornamental trees. In the planting of trees one should also overcome the craving for symmetry, and not plant exactly similar trees on both sides. In the art of decoration, balancing effect is more desirable than dead geometrical symmetry. Two groups of trees of two different sizes on both sides create an artistic balancing effect. In modern decoration the tendency is to break the symmetry in such a way that balance results.

There are some people who would rather have plants which produce flowers all the year round, rather than annuals which flower for a couple of months only. Where space is limited there is much to be said in favour of this view. Canna-beds, ornamental shrubs like *Myenia erecta*, red, yellow and orange varieties of Ixora, blue Plumbago, and *Zinnia linearis*, a perennial dwarf Zinnia with orange-coloured flowers, provide a good substitute for annual flowers. Canna-beds can be laid out opposite bathrooms, as their broad leaves have a quick rate of transpiration and provide an easy solution of the drainage problem.

Vegetable gardening has its artistic side as well. Neat rows of cauliflowers, egg-shaped white brinjals, and scarlet tomatoes look attractive. Bottle-gourds and snake-gourds, when grown over a scaffolding of tree-trunks supporting a roof of twigs, appear very charming in the month of November. Beans, pethas, and pumpkins may also be grown on such supports where they are safe from monkeys and other pests.

List of dwarf ornamental trees suitable for small compounds

I. Flowering trees

1. *Acacia auriculiformis*
2. *Alangium lamarckii*
3. *Bauhinia purpurea*
4. *B. variegata*
5. *Brownea coccinea*
6. *B. ariza*

7. *Butea frondosa*
8. *Cassia fistula*
9. *C. javanica*
10. *C. marginata*
11. *Cochlospermum gossypium*
12. *Cordia sebestina*
13. *Crataeva religiosa*
14. *Erythrina blakeii, E. crista-galli*
15. *Guaiacum officinale*
16. *Giliricidia maculata*
17. *Holarrhaena antidysenterica*
18. *Jacaranda mimosaefolia*
19. *Kleinhovia hospita*
20. *Lagerstroemia thorelli*
21. *Mesua ferrea*
22. *Milletia auriculata*
23. *Pongamia glabra*
24. *Plumeria rubra and P. alba.*
25. *Saraca indica*
26. *Solanum wrightii*
27. *Spathodea nilotica*
28. *Sterculia colorata*
29. *Tecomella undulata*
30. *Thespesia populnea.*

II. Fragrant trees and shrubs

1. *Alstonia scholaris*
2. *Anthocephalus indicus*
3. *Artabotrys odoratissimus*
4. *Gardenia lucida*
5. *G. latifolia*
6. *G. florida*
7. *Hiptage madablota*
8. *Ixora parviflora*
9. *Lawsonia alba*
10. *Magnolia grandiflora*
11. *Michelia champaca*
12. *Murraya exotica*
13. *Nyctanthes arbortristis*
14. *Schinus molle.*

III. Trees with ornamental foliage

1. *Averrhoa carambola*
2. *Callistemon lanceolatus*
3. *Citharexylon subserratum* (fiddle-wood)
4. *Polyalthia longifolia.*

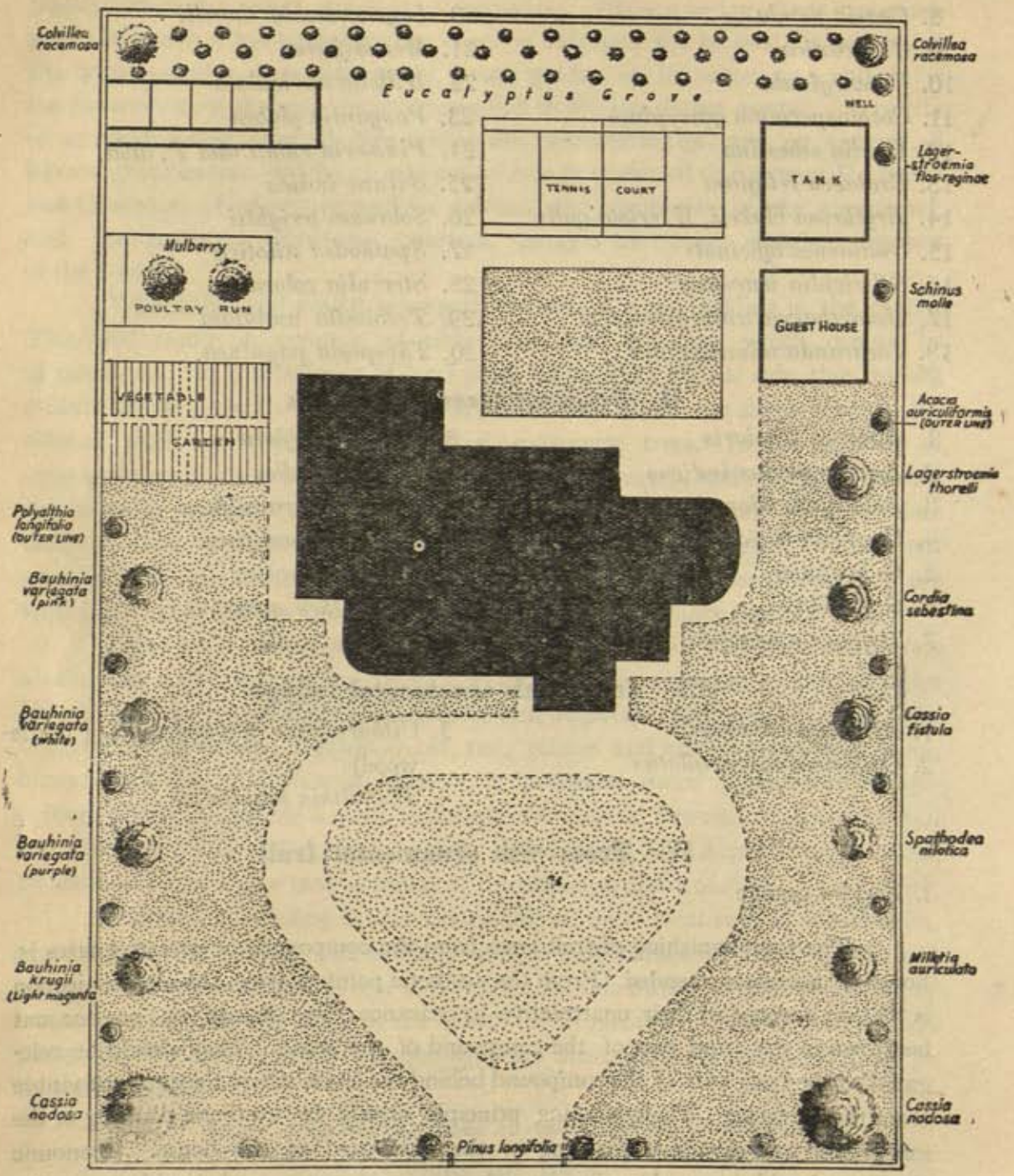
IV. Trees with ornamental fruit

1. *Hazara* orange.

Fruit trees in compounds of houses

The total banishing of fruit trees from the compounds of private houses is, however, not recommended. From the aesthetic point of view, the main objection is that on account of their unattractive appearance they should on no account be grown in the front part of the compound of the house. They should be relegated to the back part of the compound behind the house where they are not visible from the entrance. The governing principle should be aesthetic planting in the fore-ground and economic planting in the back-yard of the house. Economic planting should be unobtrusive enough to escape notice and should attract the least attention.

Another nuisance which results from the planting of mangoes and guavas is that of flying foxes and parrots. While the flying foxes produce eerie noises at



A formal planting scheme for a double storeyed house in a plot of land two acres in area

night time, the parrots play havoc with the fruit during day time. As Mr. M. D. Chaturvedi observes, 'On no account, should a residential compound be permitted to degenerate into a fruit garden with the necessary accompaniment of contractors, *malis* and beating of kerosene tins and other weird noises devised to scare away birds and animals.'

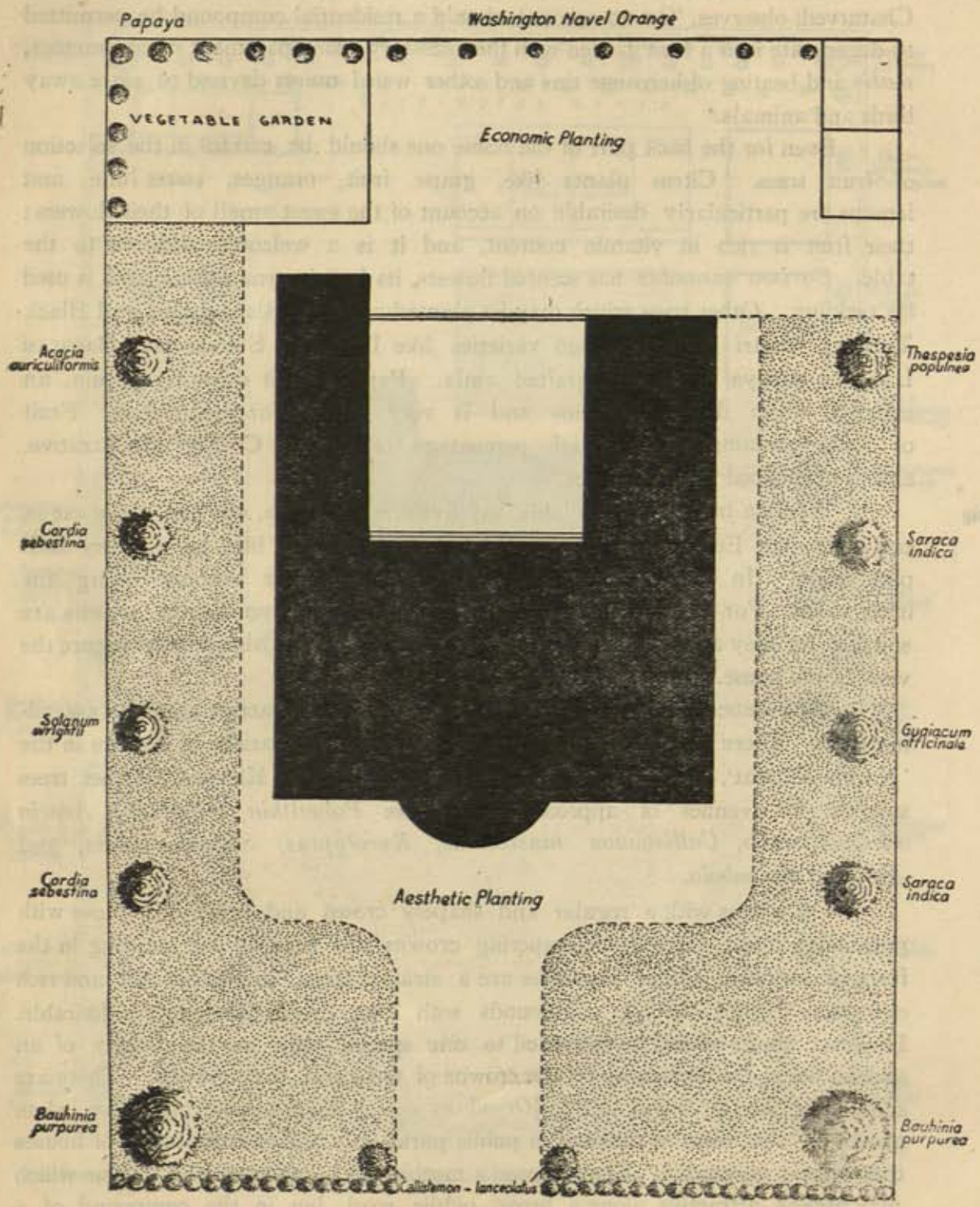
Even for the back part of the house one should be careful in the selection of fruit trees. Citrus plants like, grape fruit, oranges, sweet lime and lemons are particularly desirable on account of the sweet smell of their flowers; their fruit is rich in vitamin content, and it is a welcome addition to the table. *Carissa carandas* has scented flowers, its fruit is ornamental, and is used for pickling. Other trees which may be planted are figs (Black Ischia and Black Turkey), dwarf grafted mango varieties like Dussehri, Sufeda and Banarasi Langra, papaya, bel, and grafted amla. Papaya fruit contains pepsin, an enzyme which digests proteins and is very helpful for meat-eaters. Fruit of amla contains a very high percentage of vitamin C. Figs are laxative, and are beneficial for dyspeptics.

Compounds of big houses

Where a big area is available, say five acres or more, one can make use of tall trees like Eucalyptus, trees with spreading crowns like gul mohurs and pink cassia. In such compounds one can also have avenues along the inner roads. For avenues, trees with long, linear, and symmetrical crowns are suitable, for they appear graceful when grown in a line, and also do not obscure the view of the house.

An avenue of *Polyalthia pendula* appears very attractive along an ascending road. There is a beautiful avenue of this pendulous variety of Asokan in the 'Kamla Retreat', house of Sir Padampat Singhania at Kanpur. Other trees suitable for avenues of approach roads are *Polyalthia longifolia*, *Acacia auriculi-formis*, *Callistemon lanceolatus*, *Eucalyptus*, *Sterculia alata*, and *Averrhoa carambola*.

Only trees with a regular and shapely crown and preferably those with pyramidal, linear, or spire-like tapering crowns are suitable for planting in the form of avenues. Other requisites are a straight stem, preferably tall, and rich evergreen foliage. In big compounds with long drives, avenues are desirable. However, choice should be restricted to one species only, as the beauty of an avenue lies in the uniformity of the crowns of trees and their growth. There are some trees like the Royal Palm, (*Oreodoxa regia*) which appear attractive when grown in the form of avenues in public parks only and in compounds of houses they appear unsuitable. They impose a mechanical regularity on an avenue which may appear attractive along a broad public road, but in the compound of a house it is irritating.



A scheme of evergreen flowering trees for a small house

Three to four rows of Eucalyptus trees grown at the back of a big house, provide a grand background. Eucalyptus is a gregarious tree which looks attractive only when grown in a clump. A single row of Eucalyptus at the sides of a house looks ugly as well as awkward. If it is desired to have Eucalyptus at the back, plant three to four alternating rows close together. Colvilleas which also grow very tall, look very majestic when grown at the corners in the back row.

A big compound also provides scope for planting of dwarf ornamental flowering trees in clumps, and in alternating rows. Even if big trees are grown, overcrowding should be avoided and the temptation of planting too many trees should be resisted. Better confine your choice to a few select trees rather than aim at the creation of a botanical garden.

Asokan can be effectively used for screening off the compound of a big house from a public road. The asokan avenue along the compound wall of the Government House at Lucknow is an admirable example of this type, and a thick, close-growing row of asokan forms a tall hedge not only ensuring privacy but also acting as a filter for dust.

While symmetrical placing of trees may not be desirable in a small compound, it is necessary in a big compound with a building of a large size. Such a building should be placed in the centre of the plot. In front one may have a circular or semi-circular lawn as the space permits, fringed by a road. In the centre of the lawn one may plant a solitary tree with a spreading crown like gul mohur, or pink cassia. If one's predilection is towards water plants, one may place a pool in the centre with red lotuses, and white and blue-purple lilies. Small larvicidal fishes can also be reared in such pools to keep them clear of mosquitoes. The amazing assortment of white, and blue-purple lilies, which Rai Bajrang Bahadur Singh, the taluqdar of Bhaduri in Partabgarh district in the United Provinces has been able to collect, is a good illustration of the beauties of aquatic gardening which can be enjoyed by the owners of big houses and large compounds with irrigation facilities. Even if a pool for the culture of aquatic plants is not regarded as desirable, it is advantageous to have a small swimming pool at the back of the house built sufficiently high with its waste water discharging into the lawn and the garden.

List of ornamental trees suitable for big compounds only

I. Beautiful flowering trees

1. *Anthocephalus indicus*
2. *Bombax malabaricum*
3. *Cassia nodosa* and *C. grandis*
4. *Chorisia speciosa*
5. *Colvillea racemosa*
6. *Lagerstroemia flos-reginae*
7. *Millingtonia hortensis*
8. *Peltophorum ferrugineum*
9. *Poinciana regia*
10. *Sterculia colorata.*

II. Fragrant trees

1. *Dillenia indica* (Chalta)
2. *Mimusops elengi* (Moulsari)
3. *Pterospermum acerifolium* (Kanak Champa)

III. Trees with ornamental foliage

1. *Eucalyptus* (all species)
2. *Phyllanthus emblica* (Amla)
3. *Putranjiva roxburghii*
4. *Terminalia arjuna.*

IV. Shade trees

1. *Diospyros embryopteris*
2. *Ficus retusa*
3. *F. infectoria*
4. *Kigelia pinnata*
5. *Tamarindus indica*

CHAPTER 13

Avenues for National and Provincial Highways

PLANTING of a tree to provide shade to way-farers and cattle was regarded as an act of piety in ancient Hindu India. Emperor Asoka was one of the earliest Indian monarchs who planted shady trees on roads and in public places. The Moghuls, too, realized the necessity of shade on the roads which they constructed. But, there was no conscious planning ; and Peepal, Banyan and Pakar trees were indiscriminately mixed with Neems, tamarinds and Mahuas. It is only in Kashmir that they showed some preference for planning and planted magnificent avenues of Chenar along the banks of river Jhelum, which can be seen at their best at Gandharbal and Matan on the way to Pahalgam. Conscious planning of avenues in Europe dates from the sixteenth century when Francis I of France adopted an organized scheme of planting Lombardy poplars along the main roads of France. The beautiful French roads with their grand avenues of spire-like poplars are the result of his effort and his successors carried on his policy over a long period. The early French emigrants carried the Lombardy poplar to Canada, and we find the graceful tree extensively planted along road-sides in the province of Quebec.

Plantation Plan for our Highways

A plantation plan for our National, Provincial and District highways is urgently wanted. In such a plan the climate of a place, its temperature, rainfall, soil, and water level should be carefully considered and suitable species selected. At present, our roads are planted by P. W. D. engineers who are ignorant about trees. Ultimately, planting of trees and replacement of dead trees is left to malis who may plant any tree which is handy. The result has been unfortunate and our road-side avenues have become mixtures of odd trees, and present a patchy appearance.

Avoid Mixtures.

M. D. Chaturvedi, a forest officer, drew attention to the necessity of a national policy for road-side avenues in 1937 in his valuable pamphlet on 'Road-side Avenues', which reveals an imaginative approach to this problem of supreme national importance. Some of his ideas were followed by D. L. Sah who drew a 'Working Plan' for avenues of P. W. D. roads in Kanpur district, in 1939. This is a pioneer attempt to develop a certain mileage according to a plan. However, considering the total mileage of our roads it is merely a drop in a bucket. What is desired, is a plantation plan for the roads of the whole country.

On account of indiscriminate planting and thoughtless replacements our road-side avenues have become very much mixed. Due to the difference in the shape of their crowns and rate of their growth they have a patchy appearance, and from a distance present a jagged skyline. On the other hand if we plant *pure* avenues with one species only for a number of miles, they will look harmonious and pleasing, and the sky-line will be regular and wave-like. *It is therefore very essential that mixtures of different species be avoided and we should have pure avenues of a single species for long stretches* of roads. This will not only improve their appearance, but also render management more economical, re-plantation easier and will rationalize their exploitation for commercial purposes. If Mahuas and Neems are grown in pure avenues for miles, oil-crushing industry can easily be started in such districts. Growth in compact areas will effect saving in transport. Similarly furniture-making industry can be encouraged in sub-Himalayan districts which specialize in Sheesham, Sal and Teak. Tamarind fruit which now only serves as a staple diet of monkeys can be profitably exported to the East Punjab and West Pakistan. Mahua flower can be used in the manufacture of power-alcohol.

Shade.

The main function of a road-side avenue is shade. Hence trees which are quick-growing and provide dense shade should be selected. The trees selected should provide shade not only on the sides, but also in the centre of the road. From this point of view, trees with an umbrella or sub-umbrella crown like Neem, Mahua, Imli and Aam are more suitable than trees with a linear

Rich yellow colour of Amaltas flowers brightens the road-side avenues of Lucknow.

elongated crown, like Teak, Eucalyptus and Millingtonia. If the trees selected provide shade, and also yield valuable timber or fruit, they are still more desirable. The trees should be planted 40 feet apart so that their crowns may develop freely. Where the road is more than 100 feet wide, a double avenue of trees, with the outer avenue near the boundary line, should be grown A section of the Lucknow-Rae Bareli road has such a double avenue and the road is very shady and cool.

Selection of trees

Trees for roads should be selected with due regard to rainfall, soil, temperature, and water-level. *Only those trees should be grown along roads which provide thick shade and are also valuable from the economic point of view.* The following trees which are also shady and yield products of economic value are recommended.

1. Neem (*Melia azadarach*). Its leaves and bark are used for medicinal purposes and its seeds yield valuable oil. It can grow on alkaline *Usar* soil.

2. Mahua (*Bassia latifolia*) Fruit is edible and the seed yields oil. It is also ornamental and its copper-red leaves appear beautiful in the months of March and April. Suitable for clayey soil, it can also stand semi-alkaline soil.

3. Imli (*Tamarindus indica*), a beautiful tree which stands the dust of roads very well ; its fruit and timber are also valuable. Suitable for dry areas.

4. Sheesham (*Dalbergia sissoo*) yields excellent timber. Suitable for Sub-Himalayan districts with rainfall over 40 inches.

5. Mango (*Mangifera indica*) yields valuable fruit and dense shade. Suitable for clayey or mixed soil with water-level 30 feet or less.

6. *Albizzia procera*—(Sufed Siris). A quick-growing beautiful tree. Grows easily on sandy soil. On account of the light yellow colour of the trunk, it reflects even weak light. An excellent road-side tree.

7. *Pithecolobium saman* (Rain Tree). Suitable for moist districts, with rainfall over 40 inches.

Trees Unsuitable for Road-side Avenues

The following trees should, on no account, be planted along the road-side.

I. Brittle Trees.

(1) *Eucalyptus*. All species.
(2) *Millingtonia hortensis* (Neem chambeli).
(3) *Eugenia jambolana* (Jaman).
(4) *Albizzia lebbek* (Kala Siris).
(5) *Cassia siamea*.
(6) *Ficus glomerata* (Gular).

All these trees are fragile with very weak wood and consequently break easily in a wind-storm. The result is that after a heavy storm roads become blocked and traffic is stopped for considerable lengths of time, and during a storm these trees are a positive menace to the lives of unfortunate travellers who happen to be on the road. Besides Eucalyptus and Neem Chambeli have linear elongated crowns which provide poor shade.

II. Thorny Trees.

(7) *Acacia arabica* (Babul).

(8) *Acacia modesta* (Phulahi).

(9) *Zizyphus jujuba* (Ber).

These are thorny trees and their thorns are a nuisance for pneumatic tyres of small cars, cycles and motor cycles.

CHAPTER 14

Avenues for Town Roads

IN India, we have the largest number of flowering trees in the world, indigenous as well as exotic, which we can utilize for beautifying our towns. On account of the diversity of climate and soil, we can grow almost any tree from temperate rhododendrons and double-flowering cherries to tropical Amherstias and Browneas. Compared with our opportunities, our achievements are however puny. Barring a few cities like New Delhi, Lucknow, Patna and Bangalore, we have made little use of the tree material available in our country.

Road-side Avenues in Other Countries

Even in countries in the temperate zone, where modern western civilization has made comparatively greater progress, it is only recently that attention has been drawn to the use of trees for beautifying towns. Barring France and Italy, where Lombardy poplars are extensively grown, we find little beauty in the town roads of Europe. With the intensive house-building activity which followed World War I, people in England awakened to the necessity of planting their town roads with beautiful trees. The outer streets of Birmingham show careful planning with liberal use of trees and grass. In Liverpool grass is grown even between tram-lines with flanking hedges.

The French immigrants introduced the Lombardy poplar in Canada, and it is commonly grown as a roadside tree in the cities of Quebec and Montreal. Maple, which is the national tree of Canada, as oak is of Germany, is extensively

grown as a roadside tree in Canada and eastern U. S. A. Of all the cities in the temperate regions, the city of Washington is, perhaps, the most aesthetically planted. The amber, yellow and coppery tints of maples, oaks and chestnuts in the Rock Creek harmonising with the yellow colour of buildings in the autumn months of October and November leave an indelible impression on one's mind. Japanese double-flowering cherries and peaches, dogwood trees with white and pink flowers, and fragrant magnolias lend grace to the state buildings and monuments of this beautiful American city.

However, as compared with tropical and sub-tropical countries the tree material available to the inhabitants of temperate countries is comparatively prosaic. Trees with brilliant flowers and birds with gay plumage occur only in the tropics and sub-tropics. Temperate countries of Europe and America have hardly anything to match the blazing Gul Mohur avenues of Kandy, brilliant blue *Jacaranda* avenues of Johannesburg and graceful palm avenues of North African towns.

Considerable attention has been paid to the lay-out of avenues in Cairo. Along the long road leading from Gizeh to the pyramids, we find a beautiful avenue of alternating Gul Mohur and *Eucalyptus*. *Jacarandas* are planted extensively along roadsides, and also date-palms mixed with clipped box-like trees. Clumps of date-palms are grown in the backyards of houses. In Morocco, the French colonials have planned the roadside avenues of their towns in an artistic manner. In the main thoroughfare of Rabat, a dwarf variety of date-palm, is grown in the form of avenues with grass and beds of annuals at sides. Triangular plots in the town are planted with Persian Lilac, and *Schinus terebenthifolius* which bears red berries in profusion in the month of November. The compounds of private houses are enlivened by orange flowers of *Bignonia venusta*, magenta coloured Bougainvillaeas, and bright-blue shrubs of *Plumbago capensis*.

Ordered variety.

The broad aims of town planning are, that the towns must be made more efficient, more healthy and more beautiful. For making them healthy and beautiful we require not only spacious well-planned streets designed as a unit, but, also, well planned roads and parks with planned plantation of ornamental trees. What is desired is *order*, which is not the same thing as uniformity. Dead uniformity with the same stamp placed on all the houses and trees in the whole town will be as undesirable as our present confusion with every one following his own sweet will and spreading ugliness. What is desired, is orderly variety with not only houses in a street following a particular design but trees as well planted and replaced from time to time according to a plan.

Road Plan and Plantation Plan

For our towns, we are not only in need of a ' Road Plan ' for traffic but also 'Plantation Plans'. *For every town of importance a 'Plantation Plan'*

should be drawn up and rigidly adhered to. For new roads, it is comparatively easy to plan plantation of unfamiliar flowering trees, but it is the old roads which present a problem. The wholesale cutting of existing trees will render them shadeless. Hence the only practical approach is *replacement of dead, decaying and old trees according to a plan*, and removal of young trees planted within 2-3 years. Once a plan is made, it should be rigidly followed not only in new plantations but also in replacements. Some imaginative person planned beautiful avenues of flowering trees for the Banaras Hindu University, which have disappeared or have become patchy on account of the absence of a plantation plan, and lack of aesthetic taste in those, who, later on, managed them. Every one cannot appreciate colour and beauty. While we call to our aid painters and artists for furnishing and decorating our houses, we should also take the help of aesthetically gifted arboriculturists. The arboriculturists should be selected from those who have an eye for colour and beauty, and they should also be given training in art schools in garden designing and theories of colour harmony and colour contrast. The artist should be introduced to the garden, and the arboriculturist should be initiated into the arcana of the art school. Both will be gainers from this experience. While the fresh breeze of the garden, and the glamour of Erythrinas, Colvilleas and Amaltas will invade the studio, freshening the minds of the artists, the garden will also gain from the impact of imaginative and sensitive minds, who will be able to convey their experience to the common man in the form of beautiful pictures. Thus, the blaze of Gul mohurs, the glory of Colvilleas and the splendour of kachnars will brighten our homes throughout the year, even when other flowers are dead and gone. On the other hand, we will be spared the pitiable spectacle of arboriculturists who plant peepal and sheesham trees on our roads in the towns.

Choice of Trees

While shade and economic utility should be the criteria for selecting trees for national, provincial and district roads passing through the country different types of trees are required for town roads. *For roadside avenues in towns and cities, shade and beauty are the sole criteria* which we should consider while selecting trees. Unfortunately, there are very few trees which combine shade with beauty of flowers, for the large majority of our flowering trees are deciduous. Where space available is limited and only one row of trees can be grown on each side of the road, flowering trees like Gul mohur, Amaltas, *Jacaranda*, *Erythrina* and *Spathodea* may be grown alternating with shade trees like *Eugenia operculata*. Choice should be restricted to one species only for each street. Very tall trees like *Eucalyptus* and *Millingtonia*, and trees with spreading crowns like banyan are unsuitable for town roads, for they interfere with electric wires. Medium size trees like *Eugenia operculata*, and Pakur (*Ficus infectoria*) which are extensively grown in New Delhi

are ideal for shade, while for beauty we have a large number of trees to choose from.

Double Avenues for cities

Double avenues of trees are a necessity in big cities, where wide roads are available. In an ideal road for a traffic centre of the metropolis, provision should be made for fast moving traffic such as motor cars and lorries and slow moving traffic such as horse-drawn vehicles, bullock carts and bicycles. A road divided into four sections for slow and fast traffic on each side, separated by islands planted with grass and shrubs in the middle and flanked by footpaths for pedestrians should be our ideal. *We recommend double avenues of trees on outer sides of the footpaths; an outer row of shade trees and an inner row of ornamental flowering trees.* The outer row should be composed of evergreen shade trees with dense foliage, such as Tamarind, *Polyalthia longifolia*, *Eugenia operculata*, *Putranjiva roxburghii*, moulsari (*Mimusops elengi*), *Ficus retusa*, Neem (*Azadirachta indica*), and Pakur (*Ficus infectoria.*) The function of the outer row is of shade only. These trees *should be planted in pure avenues and not in mixed patches.* Growth in pure avenues provides a beautiful skyline and a pleasing effect due to uniform size and shape of the crowns of the trees of the same species, while a mixture creates an ugly confusion with a jagged skyline. The inner rows should be of ornamental flowering trees only. The outer rows of shade trees will provide shade for pedestrians on the footpaths and at the same time will furnish a green background for the pink, red, crimson and yellow flowers of the flowering trees. The trees in both the rows should be planted at a distance of 30 feet from each other with the trees in opposite rows alternating.

Naming of streets and roads

In modern towns constructed in the form of blocks, numbering of streets is desirable, as it is the easiest guide for a newcomer. In old towns we usually find the roads and streets named after historical personages, officials, and lately after municipal commissioners who regard the naming of roads after them as the royal road to fame and immortality. The result has been encrusting of the road crossings with clumsy sign-boards, particularly when the seeker after cheap popularity insists upon retaining all customary titles. This involves waste of time and energy in correspondence and those who have to send telegrams should be justified in sending a bill to the immortality hunting gentry who, while perpetuating their own memory, cause so much inconvenience to others.

Bioaesthetic planning will also simplify the problem of naming roads and streets. The streets can be named after the flowering trees which are grown on the road, such as Amaltas Avenue, Kachnar Avenue, Gul Mohur Avenue, Asoka Avenue, etc. Not only the roads will be readily recognizable, but this device will also enable the citizens to familiarize themselves with our

common flowering trees. Some imaginative pioneer has actually named a road in Lucknow as Millingtonia Avenue after *Millingtonia hortensis*.

Triangular islands

In every big town, we find triangular pieces of land at the junction of roads. To safeguard against traffic accidents these plots are not leased for building purposes. There are many such triangular plots in the Civil Lines of Allahabad. At present they are lying neglected, covered with ugly self-grown jungle trees. How beautiful they can be, particularly the sunken ones, if they are planted with flowering trees. Only one species of trees should be planted in each triangle. Covered with Spathodeas, Lagerstroemias, Jacarandas and Kachnars, these triangular plots will appear very beautiful, serving as nodal points of beauty, affording welcome shade to pedestrians, and a refuge for young lovers.

Beautiful roads, well-planned parks and squares will bring the beauties of nature within the reach of the common man in our towns and cities. The dwellers of slums will also appreciate the beauty and splendour of flowering trees, at least their children will, who will have the opportunity of growing up in a new environment. Those who have lived in filthy surroundings for generations cannot be suddenly transformed, in a few years, into lovers of beauty. But the attempt is certainly worth making and results will be tangible after some time.

Some Colour Schemes

While most of the flowering trees look beautiful when planted in pure avenues, there are some species which flower at the same time; the colour of their flowers also harmonizes, and hence appear more effective when planted side by side. Some of the flowering trees which flower in the same season, are grouped below in schemes with due regard to colour harmony and are recommended for planting along our town roads:

SCHEME No. 1.

Amaltas	*Gul Mohur*	*Amaltas*
(Yellow)	(Scarlet orange)	(Yellow)

This is a very striking colour scheme, the rich yellow colour of Amaltas flowers contrasting with the scarlet orange colour of gul mohur flowers in the month of May ,when both the trees are flowering.

SCHEME No. 2.

Peltophorum ferrugineum Rusty Shield Bearer (Golden yellow)	*Colvillea racemosa* Colvilles Glory (Orange red)	*Peltophorum ferrugineum* Rusty Shield Berar (Golden yellow.)

This colour scheme is very effective in October, when both these trees are flowering and a colour effect similar to that in scheme No. 1 is produced.

SCHEME No. 3.

Jacaranda mimosaefolia (Blue)	*Grevillea robusta* (Yellow)	*Jacaranda mimosaefolia* (Blue)

Both these trees flower in April together and a beautiful colour-effect is produced, which is soothing in the glare of April sunshine.

SCHEME No. 4.

Spathodea nilotica Fountain tree (Orange crimson)	*Erythrina indica* Scarlet Erythrina (Scarlet red)	*Spathodea nilotica* Fountain tree (Orange crimson)

Both these trees flower in March, when they are a blaze of colour.

SCHEME No. 5.

Cassia nodosa (Pink)	*Cassia marginata* (Pinkish red)	*Cassia nodosa* (Pink)

Both these trees flower in May and June when a very mellow colour scheme of pink and red is obtained.

SCHEME No. 6.

Bauhinia Scheme.

Bauhinia variegata. (Purple-mauve Var.)	*B. variegata* (White Var.)	*B. Krugii* (Light magenta)	*B. variegata* (Light pink Var.)

This colour scheme which is composed of three varieties of *Bauhinia variegata*, pink, white and purple-mauve, and light magenta (*B. Krugii*) is recommended for dust-free roads of residential areas. All these Bauhinias blossom in a leafless condition from the middle of February to the middle of March when they look like huge bouquets of pink, white, purple and light magenta flowers. This is a very pleasing colour scheme and is highly recommended.

AVENUES FOR TOWN ROADS

List of ornamental trees suitable for Town Roads.

No.	Foliage trees for outer Avenue	Flowering trees for inner Avenue
1.	*Averrhoa carambola* (kamrak) ..	*Cassia fistula* (amaltas)
2.	*Callistemon lanceolatum* (Bottle brush tree) ..	*Bauhinia purpurea*; *B. variegata*
3.	*Anthocephalus cadamba* ...	*Colvillea racemosa*
4.	*Eugenia operculata* ..	*Peltophorum ferrugineum* (Rusty shield bearer)
5.	*Polyalthia longifolia* (asokan) ...	*Spathodea nilotica*
6.	*Putranjiva roxburghii* (jia puta) ...	*Jacaranda mimosaefolia*
7.	*Sterculia alata* (Australian Bottle-necked tree) ...	*Poinciana regia* (gul mohur)
8.	*Pithecolobium saman* (Rain tree) ..	*Lagerstroemia flos-reginae and L. thorelli*
9.	*Melia azadirachta* (neem) ...	*Grevillea robusta*
10.	*Tamarindus indica* (imli) ..	*Gliricidia maculata.*

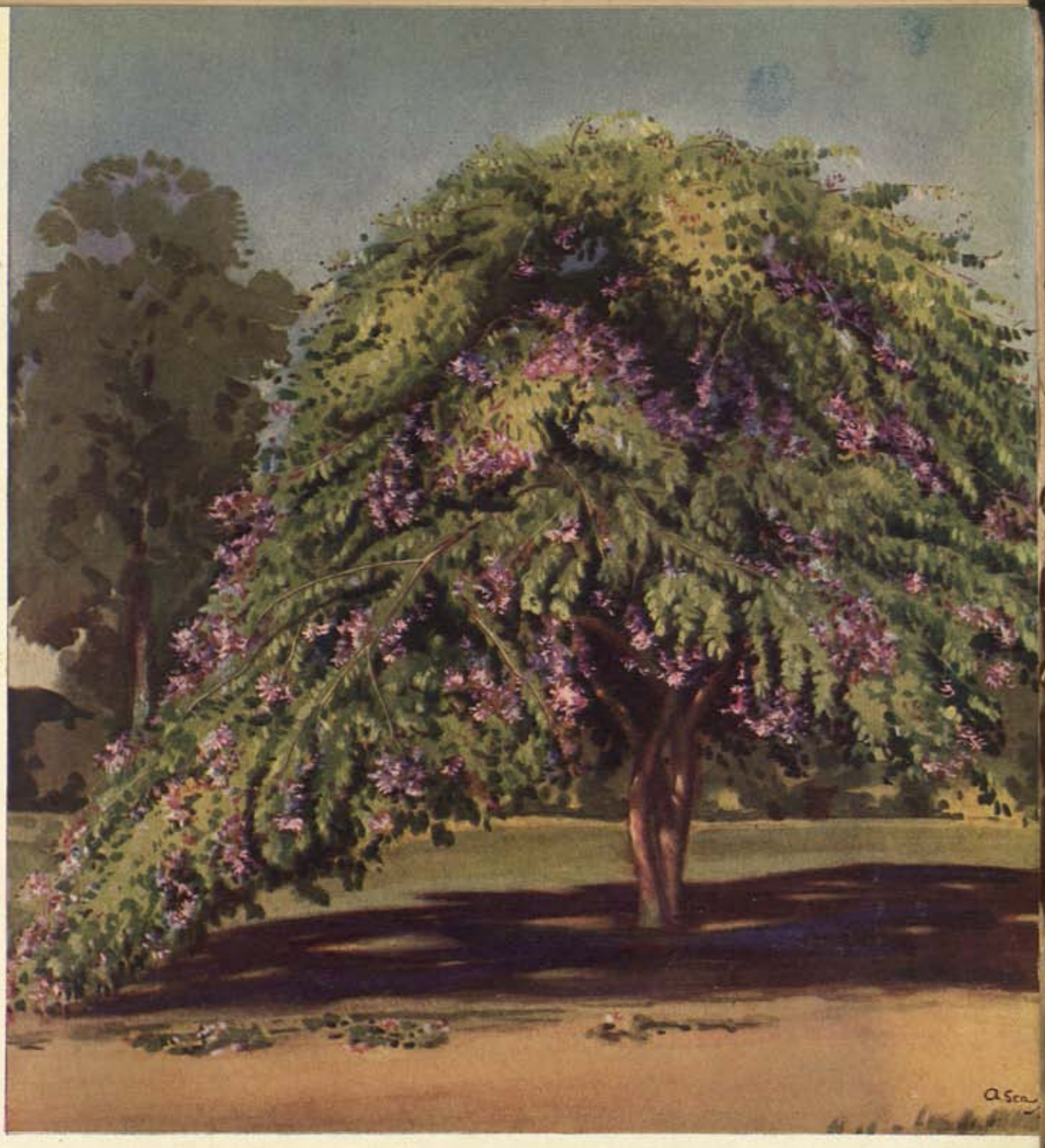
CHAPTER 15

The Tree Planting Plan of New Delhi

WHEN Sir Edwin Lutyens came to New Delhi, he asked for a list of trees which could grow there. Griessen of the Horticultural Department prepared a list of trees and tree-like shrubs that might be made use of in the planting of the New Capital at Delhi. Griessen planted the laid out roads, but on account of unsatisfactory water supply most of the roads had to be replanted several times. Griessen retired in 1920 and was followed by Mustow who established the nursery at Jor Bagh opposite the Safdar Jung tomb. Hence forward most tree planting, and much that grows in New Delhi, owe their existence to Mustow. He aflorested the ridge. He introduced the 'Mesquit' from Mexico, and thus gave India a hardy tree which may even help to make Rajputana green. Generally road avenues were inter-planted; quick growers between the permanent and slow growers. Most of that inter-planting has been cut out.

A model plan

The tree planting plan of the modern city of New Delhi can serve as a model for many of our towns which have irrigation facilities. Extensive use has been made of many of our flowering trees for brightening up the housing areas, squares and circuses. For avenues *Eugenia operculata*, with its light green leaves has been found to be the most suitable in New Delhi. It sheds its leaves in late February, and renews them in early March, after remaining leafless for only a few days. It has a compact semi-globose crown and its light green leaves are very soothing to the eyes. Avenues of this beautiful evergreen species adorn the parks on both sides of the Kingsway and are, also, planted on



Bauhinea Purpurea brightens the compounds of many bungalows in New Delhi.

many roads. Other successful roadside trees are *Kigelia pinnata*, *Pongamia glabra*, *Ficus retusa*, *Ficus infectoria*, *Celtis australis*, *Sterculia alata*, *Cassia fistula*, *Anthocephalus indicus*, *Piptadenia oudhensis and Melia azedarach*.

The Secretariat and the Government House are the nucleus of the layout of New Delhi, and a number of roads radiate from them. The clipped bushes of *Diospyros cordifolia* in the lawns in front of the Government of India buildings look very attractive. The trees annually receive a light pruning treatment, the branches being cut at a certain height above the ground. This leaves space for pedestrians to wander below, and the pathan-type of hair-cut which the trees receive gives them a smart appearance. The clumps of Jacarandas on the corners of the two Secretariat buildings are a sight in the month of April.

Most of the circuses in the centre of road junctions are enlivened with clumps of flowering trees like *Jacarandas*, amaltas, gul mohurs and kachnar. Where space available is narrow, use has been made of shrubby climbers like the various species of *Bougainvillaea* and *Petraea volubilis*.

The squares in housing areas have been planted with all types of flowering trees. The *semals* in Hastings Square with their flaming red flowers are a sight in the months of March and April. Purple and mauve kachnars lend their grace to many squares, though they have a rough time at the hands of clerks and the members of their families who pillage their buds ruthlessly for curry.

Beauty and utility

Flowering trees have also been planted at the edges in the compounds of bungalows which are maintained under the supervision of the Public Works Department. At the gateways, bottle-brush trees with pendulous branches are commonly grown. We also find trees of *Jacaranda mimosaefolia*, *Bauhinia variegata*, *B. purpurea*, *Erythrina indica*, *Grevillea robusta* and *Ochna squarrosa*. In the foreground, extensive use has been made of ornamental shrubs, and pink oleanders lend their gay note to many bungalows of the capital. Scented shrubs like *Murraya exotica* and *Cestrum nocturnum* exhale their perfume in many bungalows. However, no attempt has been made to vary the planting scheme, and as a result all the bungalows look alike. By adopting different combinations of trees and by planting some of the flowering trees in pure avenues, New Delhi could have been made more colourful. Another defect from which the plantation schemes for compounds of New Delhi bungalows suffer is that fruit trees have been totally ignored, and too much emphasis has been laid on mere ornamentals. The tree planting scheme of New Delhi can be very much improved, if fruit trees like grafted mangoes, citrus plants, figs, and papayas are also planted in the back-yards, thus achieving a happy compromise between beauty and utility.

CHAPTER 16

Parks of Rest and Culture

THE importance of parks and gardens in population centres has been recognized by all who are interested in town planning.

Public parks and gardens are the lungs of the town ; they are a boon to the citizens, who can escape from the brick and mortar of endless rows of buildings and the asphalt of the roads, and feel the touch of earth and grass. And while the rich few can go to the countryside, a large mass of citizens must find relief in local parks and gardens.

As nearly all towns grow from year to year, areas for public parks should be acquired and developed with an eye to the future. The Lawrence Park at Lahore, Wingfield Park at Lucknow, and MacDonnel Park at Agra are examples of parks planned with imaginative foresight on a liberal scale, and will serve the growing population of these towns for years to come. On the other hand we see the congested city of Amritsar with a small park like the Ram Bagh, which might have been adequate when this town was merely an overgrown village during the reign of Ranjit Singh, but now appears a mean little affair.

In the lay-out of a park, the natural features of the land should be fully utilized. The science and art of the lay-out of a park should be based on Nature to achieve beauty.

Undulating land has been utilized with advantage in the MacDonnel Park at Agra, producing an artistic effect. If the site is flat and uninteresting, beautiful results can be secured by making a sunken garden, as in the case of the

The mauve and lilac pendulous racemes of Moulmein Rose-wood are a glorious sight in March.

Hewett Park at Agra, where the moat-like depression around a hillock is covered with green grass and the sloping sides are covered with a carpet of mauve verbena. Old mound-like forsaken brick-kilns (*pajawas*) have been skilfully converted into green mounds covered with trees and shrubs, in the Lawrence Park at Lahore.

A park would be dull and monotonous if it is visible all at once at one glance. Its charm lies in stimulating a sense of curiosity in the observer, and that is only possible if it is situated at different levels, intersected by canals and bridges with mounds and hillocks, concealing new vistas of beauty.

Well-maintained lawns are a great necessity in our hot climate The soothing green colour of grass and its coolness in the evenings are a great comfort to people who spend the day in cemented houses, which become hot as ovens on a May or June afternoon.

If fragrant trees and shrubs like Gardenias and the Queen of the Night are planted on the eastern and western borders of lawns, people who come out to enjoy the cool temperature of the lawns can enjoy their fragrance, for the direction of the prevailing winds in summer is west to east and in the monsoons, east to west.

Except to some extent at Lucknow and Lahore, very limited use of ornamental flowering trees has been made in our public parks. Clumps of Amaltas, Bauhinias, Peltophorum, *Cassia nodosa*, and Gilircidias should be grown and benches placed under the trees for the benefit of lovers, and parties out on picnics.

There are so many beautiful trees available for making our parks colorful in the hot months, but little use has been made of this material. We should learn from the English how to appreciate flowers, and from the Japanese how to use flowering trees for beautifying our parks and gardens. Thousands of Japanese visit the shrine of the God Tenjin in Kameido in February to enjoy the sight of white blossoms of plum trees. Hundreds of couples sip tea on benches placed under the ancient trees. At dusk, spherical paper lanterns swaying from the branches are lighted, and the white blossoms appear colourful under the reflected light of these multi-coloured lanterns. Poets write poems in praise of the plum blossoms on a special paper (Tanzaku) and they tie these oblong strips to the branches. Thousands gather at Kameido to admire the drooping purple flowers of Wistarias in May. There are many places in Tokyo which are famous for cherry blossoms, particularly Mukojima, Arakawa, Uyeno, Asukusa Hill and the Parks of Hikawa and Shiba. In early April, these places are crowded with visitors who come to admire the cherry blossoms and stay from dawn till late in the night. Old cherry trees are given special names and are mentioned with affection. Admirers of cherry blossoms carry cherry flowers in

the button-holes of their coats. People drink beer and make merry round the flower-laden cherry trees glowing with electric lights.

Festival of flowers

Our Amaltas trees look very pretty indeed in April and May. We should also celebrate festivals of flowers in summer months. Amaltas trees laden with golden-yellow drooping bunches of flowers appear very attractive and if illuminated with coloured paper lanterns, they will make our parks look like fairyland. While cherries and plums can grow in Kashmir and the frosty climate of the sub-Himalayan districts of the Punjab, they do not flourish in the United Provinces and other provinces of India with a milder climate. In these provinces Pink Cassias and *Bauhinia variegata* can be grown with ease. Pink Cassias laden with pink flowers in May and June are a glorious sight. The pink, white and mauve blossoms of Kachnar in March appear exceedingly pretty. Pink Cassias and Kachnar should be grown in clumps in our parks so that visitors may feast their eyes on their beautiful blossoms.

Tea and beer-houses, and sherbet and betel shops conveniently placed will add to the attraction of our parks. These shops should be constructed by the government with due regard to architectural beauty, and then rented out to shop-keepers. Thousands of people who come out of their houses to escape the summer heat will benefit from this convenience, and our parks will draw bigger crowds.

When huge crowds of men, women, and children assemble in public parks and gardens, to eat, drink and make merry, they are bound to create problems. They will scatter paper, crumbs of food, broken bottles and such waste, all over the place as they do in all parts of the world. Waste-paper baskets should, therefore, be provided around the trunks of trees for collecting the rubbish left by the holiday makers. As these will be an innovation in this country, people will have to be educated to use them. Notices in Urdu and Hindi such as "Please throw your rubbish here" will have to be painted on the dustbins. Our municipalities seem to have forgotten the normal functions of the human body. While in Europe there are public lavatories in nearly all main streets, even in important towns in India no such facilities are available. To prevent desecration of our public parks and gardens, therefore, privies for men and women ought to be provided wherever possible. For the needs of the children, a quiet corner away from the road should be reserved, and pucca cemented ladders-and-slides, see-saws, swings, sand-pits and merry-go-rounds should be provided. Thus the kiddies will be drawn off from the streets, and instead of proving a nuisance to traffic, they can indulge in healthy games in clean and safe surroundings.

For young men, apart from providing grounds for ball games, we should also build gymnasiums in parks to interest them in physical culture. Parachute

towers are also a necessity in this air age to make the people air-minded. In the Soviet Union, there are parachute-towers in the parks of almost every town and it will not be too utopian a demand to have them at least in the parks of our principal towns. 'Akharas' or wrestling-pits and swimming-pools should also be provided.

Around playgrounds, shady evergreen ornamental flowering trees should be planted to provide shade to the spectators. This simple suggestion is very often ignored in this country and thousands of people while watching cricket matches which last for days get roasted in the sun.

Cultural needs

It is not by eating, drinking, seeing films, dancing, and making merry that nations progress. On the contrary, that is the way to mental and moral decay and inevitable ruin. A Spartan physical discipline, combined with a rigorous training of the mind can check mental and physical flabbiness, the malaise of a capitalistic industrial civilization. The moral restraint exercised by old religions is disappearing, and people are no longer tempted by the rewards of heaven or frightened by the terrors of hell. It is not the revival of reactionary, irrational and out-moded religions of the past which will save our generation. The old religions, intolerant of intelligent criticism and allied to reaction stand self-condemned, and have lost all appeal to a thoughtful citizen. Only science and culture, and a rational knowledge of the universe and man, can fill the moral void. We must have a new faith based on science and the ideal of service to humanity. That is only possible if we achieve a social and economic organization where personal greed, selfishness, and lure of profits are at a discount.

When the citizen has done his share of the day's work, when the muscles are tired, he must fill his leisure with intellectual and cultural pursuits. The mind should seek repose in clean and healthy modes of relaxation. Desk-workers who do little physical toil require bodily exercise and relaxation in games. Above all, everyone of them is in need of cultural background and scientific knowledge; for balanced development of personality is not possible otherwise. Here is the need for science museums, art galleries, and open-air theatres in public parks. Art schools and picture galleries should be built in parks and gardens, so that students and teachers alike may dwell for a while in beautiful surroundings, conducive to the development of aesthetic taste. Music and dance schools should also be located in public parks. Thus, our parks will become centres of art and culture where people will spend their leisure in a manner conducive to their physical as well as mental well-being. There is not a single planetarium in India, while there are many in the U.S.A. and Germany. In some of our parks in big cities we should build planetariums so that the common man may get an idea of the universe in which he lives. There are still scores of

people who in spite of Copernicus, believe that the earth is flat, and the sun revolves round the earth. They have no idea that there are other planets besides our earth. A planetarium can serve a very useful purpose in widening the mental horizon of the common man.

Parks of rest and culture in Soviet Union

In the Soviet Union there are spacious parks of rest and culture in all the principal cities and towns like Moscow, Leningrad, Kiev, Kharkov, Baku, and Odessa. Many such parks have been set up in workers' settlements in the Donetz Coal Basin, the Urals, Kuzbas and even in the Pamirs. The Gorki Central Park of Culture and Rest in Moscow is the biggest in the Soviet Union, and stretches for four miles and a half along the banks of the Moscow river. It is visited by sixty to seventy thousand persons every day, and on holidays the crowds swell to three lacs. This park was laid out at the beginning of the first Five Year Plan, and is the result of the efforts of the best horticulturists, architects and artists of the Union. It serves as a source of education and recreation in joyous surroundings. It has six theatres, a circus, many cinemas and a score of band-stands for its many orchestras. Concerts of light and classical music are given daily. There is a big open air theatre where plays are staged. All types of facilities are provided for sports, and people learn to swim, skate, ski and row under the guidance of practised instructors. There are rings for boxing, wrestling and acrobatics, croquet and bowling courses, shuffle boards and shooting galleries. There is a tower for parachute jumping, and spacious enclosures for shower-baths and sunbathing.

Children can enjoy rides in merry-go-rounds, and their parents leave them in the Children's Village where they can play in well-equipped fields and a miniature zoological garden. Mammoth carnivals and large mass festivals and meetings are arranged in the park. Many of the mass festivals are new, such as the "Youth Carnival", the "Festival of Music and Song" and the "Fireworks Festival".

The park serves as a centre for the dissemination of culture, art and science. Eminent savants give popular talks on science, art, literature and technology. The park contains lecture rooms, reading rooms and laboratories. Authors and poets give readings from their books to the people. Special exhibitions, lectures and meetings are arranged to celebrate important scientific and technological discoveries, and visitors are given the opportunity of studying applied technology under the guidance of skilled instructors. Epoch-making events are celebrated in the park in a fitting manner to publicise the heroes, e. g., when the famous non-stop flight from Moscow to America was completed, a game called "Following the Route of the Heroes" was organized; to explain the work of Dr. Schmidt of Chelyuskin fame, a journey to the Arctic was staged in the skating rinks of the park.

Birla Park

The nearest approach to a park of rest and culture in India can be seen in the Birla Park of New Delhi. Resting on the western side of archaean rocks of the Aravalli ridge, under the shadow of Birla Temple, the park provides amusement to thousands. On every Sunday, there is a crowd rivalling in numbers and frivolity the Bank Holiday crowds in Hampstead Heath of London. We find people—men, women and children—ascending the stairs of the park to gape at the elephants lifting lotus-filled pots on the tips of their trunks, or to play hide and seek in the lion-faced grottos and caves. Columns bearing names and portraits of Hindu and Sikh heroes remind the pleasure-seekers of their glorious ancestors. Children swarm on the ladder-and-slides and slither in an endless procession. Women and girls buy trinkets and bangles from the pedlars, and men lie lazily on the green lawns. Young boys wrestle in 'akharas' and religiously-inclined old people listen to discourses on the Gita.

The popularity of the place shows what a need there was of a park of this nature, which provides such a happy contrast to the barren and cheerless parks and lawns provided by the Government and municipal authorities. These so-called public parks look neat and prim, but are alien to the people and not adapted to their needs. There are no ladder-and-slides for children, no sherbet and betel shops for the populace. In fact, they provide neither rest nor culture; in contrast, the Birla Park caters to the pleasure-seeking and religious instincts of the crowd. If it were not for the narrow-mindedness of the founders of the Park who have excluded Moslems from enjoying the amenities of the place, and their efforts to revive the hoary past which savors of mediaevalism, this place does deserve the name of a park of rest. Substitute science for Hinduism and combine the amenities of Birla Park with propaganda for knowledge and scientific humanism, and we get a park of rest and culture.

CHAPTER 17

A Museum of Evolution

MUSEUMS occupy an important place in the educational systems of all advanced nations. In view of its direct appeal to the inquisitive mind, the museum method is valuable as an instrument of popularising science. India has still to realize their value, although in the Soviet Union, Germany and the U. S. A., all important towns have natural-history, industrial and agricultural museums to which large numbers of citizens repair for education and entertainment.

Some of the old museums in India and abroad are, however, purposeless collections of curios and antiquities. Time has come to reconsider the organization of museums, and their place in educational systems. People who go to natural history and other museums get lost among stuffed birds and mammals, and come out confused and none the wiser. We are in need of museums which teach the basic and fundamental facts of biological and physical sciences to the people. We want museums which could give them an idea of universal history and the world as a whole; a unified conception of the world drama in which they have to play their part. The idea which H. G. Wells has attempted to give in the form of his *Outlines of History, Science, and Economics*, will be translated into a Visual Aid Museum of Education in our proposed 'Museum of Evolution' and will have a profound effect on the outlook of the young citizens of India.

Biology—a revolutionary science

Need of museums of evolution in India is particularly urgent. Perhaps a study of Biology can broaden people's minds and produce a greater degree of tolerance, so that they may realize that primarily they belong to the species, *Homo sapiens*, and they are human beings first, and Hindus, Moslems and Sikhs afterwards. Biology is a revolutionary science which changes an individual's outlook on life as no other science does. There is a common misconception that biology is merely a study of leaves and flowers of flowering plants, and of the bones of dead frogs and rabbits. A person who has never looked through the microscope at amoebae and paramaecia wriggling and rolling, at diatoms and desmids with their beautiful symmetrical shapes, the fine lace-like structure of the stem of a herb, and at the patterns of chromosomes in the dividing cell, may be excused for his ignorance. The microscope has revealed a new world which is infinitely more beautiful and with such variety in shape and form that it surpasses all imagination. A layman who has not studied the mechanism of reproduction in plants cannot imagine that they too have sex, and some like ferns, Cycas and Ginkgo, have living motile sperms as in animals. In fact, a biologist looks at plants and animals with a different eye, and the vision of life which he acquires by study and observation, greatly broadens his outlook. A study of evolutionary biology serves as solvent of religious dogmas, superstitions and misconceptions. It is only by a study of biology that the so-called inherently religious people will drop their religious blinkers and begin to see the world in the cool and clear light of science.

Museums linked with people

How can we bring the knowledge of biology to the common man? I suggest that we should open "Museums of Evolution" in the public parks of all the university towns of India. At least we should make a start by opening such museums in centrally situated towns in the country. A museum isolated from the people merely remains a store-house of curios and rarities where the curious and the ignorant gather to satisfy their curiosity, and after gaping at the exhibits return home, none the wiser for their experience. Unless our Museums of Evolution are linked with the growing generation and those who are responsible to teach them, it is unlikely that these museums will be as effective as we want to make them. To ensure the maximum use of these educational museums, we should link them with our educational organizations. Parties of students and teachers should be invited from all the schools of the province concerned and given lectures on the evolution of life and its significance, in these museums. A programme can be arranged on regional or provincial basis for all schools served by a particular museum, so that these museums and their staff remain busy all the year round. It is only in the early impression-

able period that personality is made or marred. If we could condition the minds of our younger generation in the early period of their mental growth, we shall be able to bring up a generation of rationally minded citizens.

An Educational Museum

A "Museum of Evolution" is not a natural history museum in which all types of animals, dead or fossilized are preserved. In a "Museum of Evolution" only those animal and plant types which have any evolutionary significance can find a place. It is a museum the primary function of which is educational. In a "Museum of Evolution", the evolutionary history of Life through the various geological epochs should be pictorially shown by means of mural paintings, charts, models and specimens of animals and plants of evolutionary importance. The process of evolution in the inorganic and organic world can also be shown by means of models, *e. g.*, the evolution of atoms from electrons and protons, of molecules from atoms, and of colloids from molecules, and the evolution of the planetary system from gaseous matter of a nebula. Then, we can show the progress of life through the ages from unicellular Algae and Protozoa to Coelenterates and other major Invertebrate groups, Fishes and Ferns, Amphibia and Lycopods, Reptiles and Gymnosperms, and Mammals and flowering plants to Man and the present-day vegetation, by means of mural paintings, clay models and charts. The radiation of phyla of various plants and animals can similarly be shown, and in the case of rare missing links like *Archaeopteryx* and fossil horses, plaster casts obtained from geological museums of Europe and America can serve our purpose. We can likewise show the evolution of limbs, skeleton, ears, eyes, brain, heart, kidneys, and sex organs from worms to man by means of models.

Hall of Evolution

A circular hall below the planetarium will serve as the Hall of Evolution. In this circular room all geological landscapes from the Archaean period to the 'Recent' will be shown according to the latest methods of exhibition technique. Life-like models of the extinct animals and plants against a painted background of scenery of the geological epochs will be accommodated in the hall, encased in glass covers. The director of the museum will have his seat in the middle of the museum and will be provided with a loud speaker. The lights in the different glass cases will be switched on one after the other as the lecturer explains the panorama of life from the earliest ages to the present, and with his electric pointer shows extinct animals and plants which once inhabited our earth. The arrangement can be made automatic and recorded explanation can replace the lecturer.

Those who have seen the Cyclorama picture 45 feet high and 360 feet in circumference at St. Anne de Beaupre near Quebec in Canada can visualise the educative value of our proposed Cyclorama of Life. In the Cyclorama

picture at St. Anne de Beaupre various episodes in the life of Christ are shown, from his birth to crucifixion on a circular panoramic picture, and from 1895 when this picture was displayed it has been attracting big crowds of devout Catholics from all over America. Our Cyclorama of Life will attract bigger crowds, and will mould many lives and help in making our citizens rationally minded.

Social evolution

Evolution of human society should also be shown in the proposed museum. As Kesva Panikkar suggests, facts of social anthropology should also be shown and emphasis placed on the evolution of social institutions, religions and cultures. Mural painters can easily depict the march of humanity from hunting and food gathering stage, to pastoral and agricultural stages to feudalism, mercantilism, capitalism and ultimately to socialism under the impact of modern technology. Connection between environmental conditions and food, dress, and social customs can also be shown. Further, subjects such as the evolution of coinage, of scripts; of vestigial customs and their original significance, of boat designs, of pottery, of musical instruments, of footwear and of the modern coat-collar, neck-tie and coat-tail, of styles of hairdressing from the earliest times to their decadence and recent somewhat miserable attempts at rejuvenescence, might also be usefully illustrated.

Science cinema

A science cinema seating about 400 persons would be an important section of the museum. A great deal of information can be conveyed in a short space of time by means of cinematographic films. As compared with verbal or written explanation, animated pictures make a more lasting impression on the minds of both children and adolescents. The educational value of a film is enhanced by its technical quality. Well-conceived animated diagrams and maps and high class photography make for clarity of expression and precision in the arrangement of ideas. Cinematographic films showing the process of reproduction and development of plants and animals, botn microscopic and macroscopic, should be shown to visitors, at fixed hours. A one-hour cinema programme including display of films showing evolution of living beings and unfolding the mysteries of the life, structure, and reproduction of plants and animals particularly the microscopic ones will have far grater educational value than mere display of silent labelled exhibits. The display of such films will have entertainment as well as educational value, and all educationists know that instruction imparted in an interesting manner goes home far more quickly than through mere lectures.

G. B. I. of Great Britain have produced a number of films under the title 'Secrets of Life' on biological subjects. They are mostly shorts of 10-15

minutes' duration ; slow motion has been used to record the flight of birds, speeded-up motion to show the growth of plants, and micro-cinematography to record the wonders of microscopic plants and animals. The Encyclopædia Britannica Films Inc. of Chicago have produced over 250 films on Physics, Chemistry, Geography and kindred subjects, which they sell at moderate prices to schools and other educational institutions. A complete set of these films should be acquired for the proposed museum. This should be supplemented by local production of scientific films, patricularly those showing the reconstruction of evolutionary progress of life. The Visual Education Society of Chicago, the Rockfeller Foundation, and the Universities of Harvard, Yale, and Chicago have produced films on Biology and Physical Science. The Food and Agriculture Organization of the United Nations, with headquarters at Washington has a plan for an International Film Library which will help the member countries for exchange and loan of films on Agriculture. The United Nations Educational, Scientific and Cultural Organisation (UNESCO), will be having a films department, which will promote the exchange of factual films between member countries and will compile lists of films available. Our Museum of Evolution can draw upon these bodies for supply of films.

Other visual aids

Apart from films, other visual aid devices such as Medichromes and Kodachrome View Box, projectors and film strips of the Society for Visual Education, Chicago, should also be utilized in the museum. A kodachrome stereoscope which shows seven pictures on a disc-like reel in a realistic manner in natural colours has been perfected. This device which has been named as 'Viewmaster' is cheap, and should be in every school. For teaching natural history and geography it is a valuable device and it may be sold at the museum.

Transparent photographs

Large transparencies with suitable captions explaining the significance and details of each photograph, lighted from behind can form an impressive means of communicating knowledge. With the aid of such photo transparencies, structure of atoms and molecules, pictures of sun, moon, the planets, star-clusters, nebulæ, comets, and meteors and structure of lower plants and animals, and anatomy of higher plants and animals can be shown.

Library and portrait gallery of Evolutionists

A library with a representative collection of books on evolution as well as on popular science could profitably be maintained in the museum. The library can further serve as a portrait gallery of eminent evolutionists. In the library room portraits of eminent thinkers who have discovered the theories and facts of evolution and have militantly spread the idea in face of opposition from so-called religious people should be displayed. Erasmus Darwin, Charles Darwin, Lamarck, Wallace, T. H. Huxley, Haeckel, Weissmann, Julian Huxley, H. G. Wells and other thinkers will inevitably find a place in such a portrait gallery

of evolutionists, and below their portraits, a gist of their contribution to evolutionary Biology should be given for the benefit of the visitors.

The Book Corner

Near the entrance should be a Book Corner where popular illustrated books on science, pamphlets, picture post-cards showing evolutionary landscapes, star charts and atlases, stereoscopes with Kodachrome reels and illustrated pamphlets on the Museum of Evolution should be available for sale to visitors at reasonable prices. Stereoscopic picture books, fitted with the usual red and blue celluloid orthoscopes, showing geological landscapes and forms of life prevalent in those periods, can be produced at democratic prices for sale to visitors. Picture post-cards of evolutionary charts, fossil animals and plants, and of eminent evolutionists and biologists, with brief descriptive notes, should also be produced for sale to students and visitors at cost price. The Book Corner can also serve as an information centre for the museum.

A Planetarium

Knowledge of Astronomy widens a person's mental horizon. We know that our planet is merely a speck of dust in the vast Sahara of space. The insignificance of man before the vast forces of nature is brought home to the individual who has to think of distances in terms of light years. Only by a visit to a planetarium the common man can get an idea of the universe in which he lives. It is unfortunate that while in the U. S. A. there are 5 planetariums, we in India have none. A planetarium can be housed in the dome-like upper floor of the Museum of Evolution. I often recalls with pleasure a visit to Hayden Planetarium, New York, in November, 1945. In this planetarium there is seating arrangement for about 700 persons. As I sat in a comfortable chair watching the sky-line of New York sky-scrapers on the circular wall, lights began to become dimmer, the ceiling disappeared and the sky with floating clouds and numerous stars appeared. The air was filled with faint and far off music. The lecturer pointed out the pole star, and constellations with his electric pointer. We learn why the moon sometimes appears as a crescent and sometimes as a great dish of light. Wide-tailed comets sweep the skies, showers of meteors drift silently across the clearness of the night, and the aurora illuminating the northern skies, eclipses of the sun, and thunder-storms with all the realistic accompaniment of dark clouds, and streaks of lightning are seen. Here, we find science and beauty, education and entertainment, in the ever-changing drama of the skies.

At the risk of repetition, we may, again, emphasize the necessity of bringing the receptive minds of the young and the adolescent in living contact with our museums of evolution by having pre-arranged programmes on a regional or provincial basis in which all the teachers as well as the school boys from the towns as well as the country are given an opportunity to participate.

Unless this vital step is taken, these museums will not serve the purpose they are intended to serve. It is, therefore, necessary that the present *laissez-faire* treatment of museums is abandoned in favour of a more active policy with the objective of so integrating museums into the lives of our countrymen, that they play a vital educational role.

Museums of evolution should have a prominent place in our educational plans and programmes. This is the age of visual education, and the plan of museums of evolution with mural pictures, models and specimens, which we have outlined above, can serve as a better medium of instruction than scores of schools and colleges. School teachers and students, who would come from all over the country to these museums, will become apostles of science and culture, will play an important role in educating India and in producing a generation of enlightened and cultured people, who will be in the vanguard of the world progress.

CHAPTER 18

Nature Conservation and National Parks

EXCESSIVE urbanisation and slums, which the nineteenth century industrialism created, have torn a large number of persons from the environment of trees and open fields. Thousands of townlings seldom see the morning sun and the starry sky except through a haze of dust and smoke. In sprawling cities like Calcutta and London, people get conditioned to a mode of life, a life which rolls along tarred roads to the tune of a world of noises. In such surroundings, one feels stifled, and one's soul begins to wither. After a year's stay in London I felt a strong urge for a touch of the soil. When after a long time, I handled clods of earth in Hampstead Heath, I felt revivified. It was my peasant soul craving for contact with the mother earth and longing for the solitude which the countryside alone can provide, that was finding satisfaction in an environment which was the nearest approach to a village in London. In England, under the spell of urbanism, they allowed their agriculture to decay, and only lately realisation has come to the British people that agriculture is something more than a mere industry. We should guard against the decay of our rural life, and must not lose sight of the fact which has been realised by Mr. G. M. Trevelyan : "That agriculture is not an industry among many, but is a way of life, unique and irreplaceable in its human and spiritual values."

The soul of the urbanised man is becoming more and more warped. Large number of men and women in our urban areas live maimed and thwarted lives. Living in an artificial environment they become physically and mentally more and more flabby. As Professor C. E. M. Joad observes,

> " Nature is the mother of our race; we have evolved as part of a natural process and our ancestors lived for millennia in natural conditions. As a result, there lies deep-seated within us a natural love of country sights and sounds and smells and an instinctive need for occasional moments of quiet alone with Nature. The smell of fallen leaves or new-mown hay, the tang of a mountain brook, the feel of lush meadow grass against the face, the texture of the bole of an oak, or the sight of its first young leaves showing yellowgreen against the April sky, these things touch in us an ancestral chord that stretches back to our savage, perhaps to our subhuman past. "

One of the surest remedies for curing the sickness of the soul is revival of contact with nature. While the urbanised man tries to satisfy his appetites in a world of eating houses, movies and radios, he forgets that he has a mind and a soul which, cut off from nature, the fount of all life, are slowly withering. The spirit of God manifests itself in the grandeur of the mountains, and their flower-filled valleys. in the needle-like Himalayan firs and deodars pointing their green fingers towards the sky, in the gushing torrents and roaring rivers pounding their way to the plains, in the forests blazing with blossoms of flowering trees, in the great banyan trees with spreading crowns standing and contemplating the spectacle of life, and in skeins of ducks and wild geese flapping their wings over jheels lit up by the rays of the morning sun. Our trees, our mountains and our wild birds make India what she is and constitute nature. So the preservation of our fauna and flora in national parks, nature reserves and sanctuaries is one of the conditions necessary for our development as complete human beings with minds and spirits as well as bodies and appetites.

The concept of nature conservation embraces several distinct purposes such as conservation of plant and animal life, the scientific aspect which includes biological research, field research and experiment, the amenity aspect which deals with aesthetic and recreational side, and the educational aspect. The aesthetic and recreational approach placed the main emphasis upon preserving the characteristic beauty of the landscape and upon providing ample access to and facilities for open-air recreation and for the enjoyment of beauty in those areas. The major features of the park are made easily accessible by providing roads, tracks and bridges, and living accommodation in the form of hostels etc. The scientific approach which in no way under-estimates aesthetic values, was primarily directed to the advancement of knowledge and its application to human welfare. "The educational aspect" as the Special Committee on Wild Life Conservation in the U.K. observes "is in many ways complementary to each and all of the others. True appreciation of scenery rests in part upon, and is

The golden-flowered Amáltas indicates prosperity in trade.

certainly enhanced by, some understanding of the rocks and the variety of landscape which they induce, the shape of the valleys and summits, the flow of the streams, the cliffs and the dunes and flats of the coast, and all the rich verdure with which they are clothed, are things which can invigorate and refresh the mind and upon which a deep culture can be based. The more widely this appreciation can be diffused, the sounder will be the mental and physical health of the nation".

The types of areas which are in need of conservation can be classified under the following categories :—

I—*National Parks and Nature Reserves ;* National Parks may be defined as extensive areas of beautiful and relatively wild country with characteristic landscape beauty, which are also wildlife sanctuaries for the preservation of big game, or other mammals and birds, where access and facilities for open air enjoyment are also provided, so that the people may be able to observe wild life of all kinds in its natural surroundings at close quarters. There is also need of nature reserves in the national parks, which act as breeding reservoirs for shy animals, which it is desired to encourage and which are not accessible to visitors.

II—*Geological Monuments and other areas of outstanding value :* These include rocks, exposures or sections which because of their great geological interest should be preserved as geological monuments, and which should be given the same protection as to archaeological buildings and monuments. These should be protected from mining, excavations, prospecting and drilling or similar operations.

III.—*Local Educational Reserves :* These include small areas of local country containing representative local flora, which are reserved for educational purposes for the benefit of schools and colleges.

National Parks

Uncontrolled destruction of wild life has been going on in many countries all over the world, and as a result of natural fauna has dwindled and many species have become extinct. In countries of Western Europe like England the process of death and destruction has reached such limits that the sight of a wild bird or animal is regarded as an event of such importance, that it inspires many lovers of nature to write letters for publication in the *Times*, saying that they heard a cuckoo at such and such a place. With the modern means of rapid transport such as motor car, jeep, and aeroplane, the whole world is becoming so speedily opened up to travellers, tourists and traders, and with the increasing population, so much uncultivated land is coming under the settler's plough, that the need for the preservation of fauna in national parks and reserves is being increasingly felt.

National Parks in the United States of America

Credit goes to the United States of America for giving a lead to the world in establishing national parks and reserves. The first great national park, the Yellow-stone in the United States dates from 1872. In 1916, the National Park Service of America was instituted to look after those areas of scenic beauty set aside by Congress to conserve the scenery and the natural and historic objects and the wild life therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations. These parks are also wild life sanctuaries which provide shelter to animals like bears, bisons, deer, elk, moose, antelope and the mountain sheep.

Forests in the national parks are preserved for their beauty and scientific value. In the Sequoia National Park in California are groves of the world's oldest and biggest trees, the Sequoia, which are 3,000 to 4,000 years old with trunks up to 17 feet in diameter. In Mt. Mckinley National Park in Alaska, there are extraordinary areas for the study of glacial action. In the Grand Canyon National Park of Arizona can be seen the most interesting examples of water erosion. Here the Colorado river has cut 19 canyons, of which the Grand Canyon is a mile deep, and is flanked by intricately carved and most gorgeously coloured rocks. In Saguaro National Park in Arizona can be seen segments of the oldest desert of the world with desert animal life and a large variety of cacti and other xerophytic plants. In the petrified forest of Arizona are well presered fossil tree trunks, sometimes 5 feet in diameter and 50 feet in length. These petrified logs are so well preserved that texture of the wood can be clearly seen.

In 1940, the U. S. Bureau of Biological Survey was fused with the U. S. Fish and Wildlife Service, which concentrates mainly on vertebrates including game and fur-bearing animals. The refuges of these animals are of immense size and are habitats artificially controlled or improved to accommodate or attract particular birds and mammals.

The lead of the U. S. A. has been followed by other countries such as Canada, Australia, New Zealand and the Union of South Africa. In Canada, the first national park was established in 1885. South Africa has several national parks of long standing. The Sabi Game Reserve in South Africa was founded in 1898 and it was renamed as Kruger National Park in 1926. The Albert National Park in Belgian Congo was created mainly due to the efforts of an American naturalist Carl Akeley. Due to the creation of this sanctuary for wild animals the Gorilla has been saved from extinction. Newzealand has one huge park 'Fjordland', 3500 square miles in area. In Europe, Sweden, Poland, Holland, Italy and Switzerland have established national parks and reserves.

National Parks in India

In India the necessity of creating national parks has found a tardy recognition. Dr. Baini Prasad has thus summarised information about national parks in India :

"In 1934 a very great advance was made in the United Provinces through the great personal interest taken by the enlightened Governor of the Province, Sir Malcolm Hailey, as a result of which the national parks Act of 1934 was passed. This Act provided for the establishment of national parks and for the preservation of wild animal life or other objects of scientific interest and for incidental matters provided therein. As a result, the Hailey Park was demarcated as a national park in the famous Patli Doon and the hill forests to the south of it consisting roughly of an area of 99.07 square miles. Under the Act the word 'animal' was defined as 'mammals, reptiles, or birds,' and it was an offence to kill, injure or disturb any animals or to take or destroy any eggs or nests of any birds from the park. The conditions under which the people were allowed to enter or reside in the park were laid down in the Act and were to be enforced by the forest department. In Assam certain areas had already been demarcated as game sanctuaries and more stringent action was being taken to preserve wild life which according to some reports has been reduced by almost 75% within recent years. Reference may also be made here to the Chamrajanagar Sanctuary of the Mysore State Forests which had been established with a view to offering complete immunity for animals particularly wild elephants and thereby making it possible for them to thrive without interference. Introduction of other animals not found in the area was to be attempted, and the sanctuary was to provide facilities for the scientific study of the life-histories of different indigenous species of game."

National nature Reserves

There is a clear need of establishing nature reserves within national parks. The principal purpose of such nature reserves, as given by the Wild Life Conservation Special Committee of England and Wales are as follows and are applicable to India also :

"To conserve and manage, for the enjoyment and interest of visitors, and for the use of naturalists, students and teachers, sites of biological, physiographical and geological importance and characteristic stretches of the natural vegetation. Similar considerations would apply in a less degree to other areas which, though not so valuable on strictly scientific grounds, have just as much importance because of their general charm or because they contain objects of marked beauty—whether rocks, trees, or flowering plants.

To establish breeding reserves for scientifically encouraging particular species or communities of species the preservation or wider spread of which within the park it is desired to promote. In such reserves public access would have to be more or less restricted.

To set aside areas so managed as to attract rare, interesting and beautiful species not at present living in the park or its surroundings."

The authorities responsible for the management of the reserves should keep in close touch with university and educational centres, as well as local natural history societies. A need would also arise for providing small handbooks on nature reserves, explaining with the aid of maps, photographs, and sketches the scientific significance of the reserve.

Local educational Reserves

Lack of field training for teachers as well as students, is one of the most serious deficiencies in current biological education in India. Without field training or facilities for nature study, teaching of Botany or Zoology tends to become lifeless and warped. Thus, there is need of local educational reserves for all colleges where biological sciences are taught. The local educational reserve is the counterpart of the college museum and the laboratory. These reserves would open a vast and a stimulating field of knowledge in a discipline which trains such mental attributes as acute power of observation, patience, concentration, detailed ordering of thought, and the appreciation of form and colour. Visits to these reserves under proper guidance would provide a liberal education to the students in one of the most stimulating and formative fields of thought. These are gains which cannot be quantified in terms of money. A beginning in this direction has been made in Delhi Province, where the local government has placed an area of 20 acres on the 'Ridge' at the disposal of the University of Delhi, Department of Botany. This piece of land will be enclosed with barbed wire, representative trees and shrubs would be labelled and efforts would be made to introduce other local plants also which can grow under these conditions.

Need of new policy

With the liquidation of the feudal order and the merger of states into unions, the problem of wild life preservation has acquired a new significance. Whatever may be the faults of princes and rajahs, it must be said to their credit that they preserved the wild animals and forests of their states rather well. With the growing demands of cultivators who want to save their crops from harmful animals, there is need of clear formulation of policy. There is immediate need of initial survey of all proposed national park areas. While there is necessity of maintenance of good vegetational balance and preservation of rich flora and fauna in the national park areas, the general wild life policy must be such as will not prejudice the use of developed agricultural land. The interests of the cultivator and the lover of nature must be harmonised. The apprehensions of farmers that national parks and nature reserves will develop into uncontrolled sanctuaries where pests and weeds will be allowed to flourish, and which will spread into surrounding agricultural lands must be allayed. The biologists must give lists of harmful and useful birds and animals. While the friends of the cultivator should be encouraged in the national parks, the enemies must be exterminated. The biologists should also give a finding whether

campaigns should be started for the destruction of wild boars, porcupines, monkeys, bats and parrots which cause enormous damage to crops and gardens. Before any such campaigns are started, it should be ascertained whether wholesale destruction of certain birds or animals may not have harmful repercussions, elsewhere, on account of the upsetting of balance of power between various organisms. An action which *prima facie* may appear sensible and desirable may have far-reaching and most unpleasant and unforeseen consquences fifty years hence. As the authors of the report on 'The Wild Life Conservation' observe, "A conservation policy directed to maintaining any particular biological equilibrium entails constant vigilance and a fine-scale 'management' of a kind comparable to the most highly developed farming'. The Special Committee further recommends the establishment of a National Biological Service, which should include not only systematists, but also others. As the Committee further observe, "Though the ability to recognise and name an organism is the first essential stage, it is by no means the last. The ecologist, the plant or animal physiologist, the geneticist, the student of behaviour, the soil scientist, the climatologist, and the statistician, each has his prominent place in the picture. But standing level with the biological sciences, though too often neglected in the context of nature preservation, are the geological and physiographical sciences; for it is from the nature and distribution of the rocks and from the configuration of the earth's crust that the natural beauty of scenery and its living carpet are derived ".

Protective Legislation

In January 1935, the Government of India convened at Delhi, an All-India Conference for the Preservation of Wild Life with a view to reviewing the position of fauna and flora as it existed at the time and considering generally the problem of protection of animals peculiar to India. The Conference prepared two lists of species, first animals that were to be protected as completely as possible, and second of those which could only be hunted, killed or captured under a licence, in some cases subject to a bag limit. The Conference further laid stress on the establishment of wild life sanctuaries. It was also recommended that the duty of preserving of fauna should be assigned to the forest department in the areas under their charge, and the necessity of co-operation of police and magistracy was also urged.

A comprehensive protective legislation was enacted in 1933, in the Punjab Wild Birds and Wild Animals, Protection Act. Wild birds and animals were classified into three categories:

(1) Wild birds and animals which are excluded from protection,

(2) Wild birds and animals which may be killed and captured without a license during a specified period,

(3) Wild birds and animals which may be killed or captured under a license, subject to a bag limit in some cases, during certain seasons. Shooting of these is prohibited during the breeding season, which is the close season.

To administer the Act, a Game Warden was appointed for the provinces of the Punjab and Delhi. A Game Inspector was appointed in each district with a number of Game-Watchers. In addition, District Fauna Committees with the Deputy Commissioner as chairman were established in each district for advising generally about the protection of fauna in their respective districts, and for propaganda among the general public urging the necessity of preserving wild life. The District Fauna Committee of Delhi has done exceedingly useful work. Pictorial charts showing the close season and the bird and animal friends and foes of the cultivator were published for wide circulation in schools, *panchayat-ghars* and police stations.

Protecting plants

There is need of protective legislation on the lines of the Punjab Act of 1933 in other provinces also. Moreover, the Act should be made more comprehensive ; and cognizance should be taken of the plant world, too. Plants which are rare or striking, beautiful or odd should be scheduled for protection in areas where this is necessary. Rare plants like species of *Lycopodium*, *Ophioglossum*, and *Osmunda ;* and beautiful plants like *Orchids*, *Rhododendrons* and *Meconopsis* etc. which are liable to excessive collection by botanists, and which are widely plundered and uprooted by 'pleasure' pickers should also be given protection, and their collection should be permitted only under proper control.

Trees as National Monuments

There are a number of giant trees scattered all over the country, which are known only locally, barring a few like the well-known Banyan tree of Sibpore Botanical Gardens Calcutta which covers acres of land. In almost every district, there is a tree of mythical age, which attracts the curiosity of people, and is often worshipped. Where religion has sanctified them, or superstition has invested them with magical powers, these trees are protected by the people. The *Pipal* (*Ficus religiosa*) and banyan (*Ficus bengalensis*), are regarded as sacred, and only in the direst extremities of a famine will their leaves be cut for the cattle. The *Jand* (*Prosopis spicigera*) is reverenced in the arid districts of the Punjab and is commonly selected to mark the abode of a saint or a deity, and rags are tied to its branches as offerings. There was a general sentiment against cutting of trees among Hindus, which has given them effective protection so far. In most villages sacred groves are found from which no one may cut wood or pick fruit. The Bishnois of Hissar and Rajputana object to cutting a tree growing by a pond The reverence for tree life has gone to such extremes that wood-cutting and kiln-burning are regarded as unlucky occupa-

Rhododendron tree in bloom in the Himalayas.

tions as both of them involve the destruction of living trees, and of insects in the earth in the burning of bricks. That is why wood-cutters and kiln-burners are said to be short-lived.

Where religion has given protection to certain ancient trees, little more is required. The sorrow-removing *Ber* tree (*Zizyphus jujuba*) of the Golden Temple at Amritsar, and the sacred *Garna* (*Carissa spinosa*) of village Bodal in Hoshiarpur district are trees of great antiquity, and are held in great reverence by the Sikhs. Besides these there are many trees which are in need of special protection. There is a giant Arjan tree near Agra which deserves such protection. The biggest mango tree in the world is growing in an obscure village named Burail in tahsil Kharar, district Ambala, and only came to public notice during the anti-capital agitation, as this village happened to be included in the proposed site for the new capital of the East Punjab. It has been given the name of 'Chhappar' or thatched house, probably because it gives protection to a number of wayfarers from the heat of the sun and the rain. The circumference of its stem is 32 feet. It has nine main branches trailing close to the ground, 5-12 feet in circumference, and 70-80 feet long. Each of these branches looks like a giant tree. The total area occupied by the crown of the tree is 2700 square yards. The average yield of the tree is reported to be 450 maunds. It is said that when 20 cart-loads of mangoes plucked from this tree reached Patiala, a few years ago, people asked whether a whole orchard had been plucked. It is desirable that such trees should be given legal protection as national monuments.

Plant sanctuaries in the Himalayas

Some of the Himalayan valleys are in grave danger of losing their character on account of excessive grazing and growth of *Rumex*. Apart from other vegetation, the sheep and ponies which are taken to alpine meadows above the tree line by graziers in the months of April and May, graze mainly on *Rumex*. A symbiotic relationship has developed between the sheep and *Rumex*. While the sheep feed on *Rumex*, in their turn they manure the pasture land with their droppings, which, in turn, further promotes extensive growth of *Rumex*. The result has been that more attractive, but less edible alpine plants are driven out by *Rumex*, which now covers big areas in alpine valleys of the Himalayas like that of Pindari glacier. In the interest of tourist industry, it is very necessary that some of the beautiful alpine valleys of the Himalayas should be declared as plant sanctuaries; and not only collection of beautiful and rare plants should be controlled, but at the same time, the grazing of sheep and cattle should also be prohibited. This is necessary in the interest of tourist industry, botanical studies, as well as for checking soil erosion.

Nature Conservation and soil erosion

Nature conservation, and conservation of soil, forests, grass-land and water are intimately inter-connected. Most changes in nature are slow, insidious, and not readily detectable. A change in the balance of power between small

organisms in the soil, a slowly dropping water table ; these are potent factors in the destruction of a countryside. What has to be done to conserve the soil and water resources so as to maintain or establish a series of varied and most delicately balanced conditions ? This question is just as fundamental to agriculture, horticulture, forestry, game preservation, and fisheries, as it is to the management of national parks.

Soil erosion occurs as a result of removal of plant cover on account of deforestation by man, or by uncontrolled grazing by cattle and goats, or the utilisation of grass-lands for agriculture. To understand the disastrous results of soil erosion it is necessary to know what soil is.

What is soil

Soil is more than mere disorganised rock material. It has been aptly described as a living organism. Apart from the soil particles, there are numerous bacteria, protozoa, diatoms, and other soil micro-organisms along with the decayed remains of plants which compose the soil. Leaves of trees bushes and herbs form a protective cover which acts as a sponge absorbing the run-off water. This water percolates through the humus layers to the minerals of the soil and accumulates in underground storage reservoirs, which give birth to numerous fresh-water streams. With the plant cover removed by the action of man and animals, the run-off discharge of water increases at an alarming rate. Dr. Gorrie has made observations on run-off data in the Pabbi Range, Jhelum district, and has found that in an area which is fairly covered with trees, the maximum run-off was less than 100 cusecs per square mile, while in the land, where persistent cattle and buffalo grazing has destroyed the plant cover, the run-off rose to 1,600 cusecs. Moreover, silt-laden water has a sealing effect on the pores of the soil and the amount of seepage is considerably reduced. The silt-laden water has also sand-papering action on the floor and sides of the channel. Valuable salts containing potassium, phosphorus, calcium and nitrogen are lost as well as micro-organisms, which play an important part in the proper development and functioning of the roots.

When more surface soil is washed away, clefts appear and gullies are formed. During monsoons, the rain water rapidly flows away, flooding the countryside. Thus water conservation becomes a serious problem ; water level falls and the country, in general, becomes dry and barren. The land becomes useless for agriculture and does not even produce enough grass. The repercussions of all these changes on wild life are serious. With the disappearance of grass-lands, forests and fresh water streams, wild life also begins to disappear. The erosion problem of the Siwaliks is a case in instance.

Records which are available, show that in the middle of the nineteenth century, these ranges were covered with thick vegetation, which harboured a number of wild animals. These forests were protected by the feudal landlords

and rajahs for *shikar*. In the conditions which prevailed in the last phases of the Sikh rule and the early days of British occupation of the Punjab, the hillmen further encroached upon the forests. Grazing of goats and cattle and the cutting of trees continued unchecked for a long time. In the early nineteenth century the *Chos*, which are now torrential monsoon rivers, were perennial fresh water streams which furnished valuable irrigation in the sub-montane area of Hoshiarpur. With the disappearance of the plant cover, these perennial fresh water streams became torrential monsoon rivers, which wash away large quantities of soil and have covered with sand fields which were once fertile. The forest-covered Siwaliks have degenerated into bare hillocks which are not capable of producing enough even for the starving population of human beings, goats and cattle ; much less for providing food and shelter to wild life.

What remedies should be adopted to check soil erosion ? Closure to grazing and its substitution by grass-cutting and stall-feeding, replacement of goats by sheep which are less destructive, have been suggested. Agricultural practice in areas in the Himalayan and sub-montane areas also needs to be modified. Terracing, bunding, contour ridging, contour furrowing, crop rotation and strip cropping also require attention. However, the sovereign remedy is re-afforestation, and 'PLANT MORE TREES' should be our slogan for the next decade.

CHAPTER 19

The Hindu-Buddhist Gardens

ARYANS of the Vedic times were great lovers of nature. They migrated to the plains of India from the flower-filled valleys of Central Asia, and their love for trees and flowers continued even in their new home with different climatic conditions. The very name they gave to flowers, *Sumanasa*—that which pleases the mind—reveals their love for beautiful flowers and their aesthetic sensibility. In the Rig Veda, they have sung praises of the mighty forces of nature which bring rain and thunder. They loved the rivers and the jungles, the mighty rivers swirling and foaming in the monsoons, and the forests filled with quaint trees.

Now they were in Aryavarta, the land of the lotus and brilliant sunshine. The Ganges with its life-giving water, descending from the Himalayan glaciers to the dusty plains of north India, the whole firmament aglow with the dazzling radiation of the sun, the morning haze on the lotus lakes, wide open spaces of land covered with Palash trees laden with scarlet flowers, the hot, dry wind blowing over sand dunes producing mirages of rivers and lakes attracting herds of deer for miles—such was the wondrous land of India, their new home.

In spite of all this, they missed the tulips, the roses and the violets which bloomed in their northern homes; but they soon found compensations in some trees flowering in the jungles and enlivening the dusty landscape with their golden

A Bacchanalean group from Kushan Mathura. Branches of Asoka Tree in the background.

and orange colors. Now they were in the Monsoon Forest Climate, which favours the growth of trees which are leafless before the rains, and often get covered with golden-yellow and scarlet crimson blossoms in a leafless condition, so different from the Grassland Steppe Climate of Central Asia which favours the growth of annual flowers. In the plains of northern India the scorching heat of the sun burns all herbaceous vegetation, and wild flowering annual herbs are very rare. This climatic factor considerably influenced Indian gardening in the Hindu and the Buddhist periods, so that their gardens were predominantly devoted to the growth of ornamental flowering trees, to the exclusion of flowering winter annuals which could be grown only with the aid of artificial irrigation in winter. The only flowering annuals which they grew were Gainda (Marigold), Amaranth and Tulsi. Of these, Marigold and Amaranth are easily grown during the rains and require practically no watering.

The Buddhist priests planted groves of flowering trees around their temples. They had plenty of leisure, and they lived in peaceful surroundings conducive to tranquillity of mind. Such conditions are ideal for the craft of gardening. In fact, the evolution of gardening is intimately associated with the temple and the monastery. While the Buddhist monks of India grew groves of flowering Asoka and Kadamba trees, the Chinese monks preserved rare trees like the Cryptomeria and the Gincgo. The Pipal was especially sacred to them as the Bodhisatva received enlightenment under a Pipal tree and became the Buddha, the Enlightened One, and hence it is also called the Bodhi tree. As long ago as 260 B. C. Emperor Asoka planted banyan and mango trees along the roads to give shade to the wayfarers. On the seventh pillar edict of Asoka at Delhi is the following inscription : "God's beloved, Priyadarshi king says, "to give shade to human beings and quadrupeds, I have planted banyans and mango trees".

Mathura Sculptures

Some very interesting bracket and railing pillar figures of "Woman and Tree" design, dating from the reign of Kanishka (78-101 A. D.) were discovered by Dr. Fuehrer, Curator of the Provincial Museum, Lucknow from 1888 to 1891 from an ancient site known as Kankali Tila, near Mathura City. In one of these, stands a beautiful woman in the nude, in a languorous pose under a flowering Asoka tree. In another, is a woman with luscious rounded breasts holding a sword in one hand, and touching the golden ball-like flowers of a Kadamba tree with her uplifted hand; the gentle curves of her young breasts harmonize with the spherical Kadamba flowers. There is another exquisite female figure surrounded by clusters of leaves and flowers of a tree resembling the Champak.

What do these figures of women with trees represent? Dr. Ananda Coomaraswamy's surmise that these trees and women represent the idea of fertility appears to be far-fetched. There is another figure in which a woman is shown bathing under a water-fall. That could hardly symbolize fertility. The plain inference is that these figures depict the intense love of those people for flowering trees like the Asoka and Kadamba and what they regarded as beautiful and pleasing in their everyday life. Who would not adore the yellow, orange and red bunches of flowers of the Asoka peeping out like fairy lamps from coppery-red drooping bunches of glossy, silk-like young leaves and dark-green pendulous old leaves. The Asoka seems to be one of the few trees which attracted the attention of Aryans when they came to India. This tree is mentioned in the *Ramayana* and Sita while in captivity in Lanka is supposed to have hid herself in a grove of Asoka trees while pursued by Ravana. Asoka is the harbinger of spring and allayer of sorrow, and is held sacred to Shiva.

There was a favourite festival celebrated in spring known as "*Asoka-push-paprachayika*," the gathering of Asoka flowers, when young women collected Asoka flowers, decked themselves in gorgeous clothes and inserted orange-scarlet bunches of its flowers in the mops of their glossy jet-black hair. The Asoka tree is so much associated with young and beautiful women, that a tree was supposed to flower only when its roots were pressed by the feet of a charming young girl, who kicked it at the conclusion of a dance with her left foot. Kalidas has most charmingly portrayed the scene of awakening of Asoka flowers in his play, *Malvikagnimitra*. Malvika, the heroine who is in love with Raja Agnimitra, performs a dance under an Asoka tree. On seeing the tree she says, "So this is the Asoka which wants the touch of my feet. It has not yet decorated itself with flowers." She dances, and hits the Asoka with her left foot and remarks with maidenly pride, "This Asoka would be too mean if it does not flower even now."

No wonder the Asoka was held in such high esteem; no garden was regarded complete without it in those joyful days of India.

The Kadamba gets covered with yellow ball-like flowers in contrast with its glossy, light-green leaves in July. It is usually associated with Krishna who is shown playing his flute in the company of Radha under a flowering Kadamba tree. Krishna lived near Mathura, and the popularity enjoyed by the Kadamba in this area is shown by the pictures of Krishna under the Kadamba tree and from those bracket figures of women already mentioned.

Ajanta toilet scenes

The murals in the Ajanta caves, the quintessence of Buddhist art, which date from 100 to 600 A.D., not only show the high level the art attained in that period but also give us a glimpse of the life of the common people in those times. Some of these pictures show wreaths of flowers in the hair.

of women. The ladies wore garlands round their necks and bracelets of flowers round their arms. In fact, flowers formed an integral part of their toilet. We also see a gaily attired woman holding a blue lily in one hand lying languorously on a brightly colored bed.

Kalidasa, describing in *Meghduta*, the toilet of women of his age observes : "The women of Alakapuri rub the dust of Lodhra flowers on their cheeks, Maghya flowers decorate their temples, Kuruvaka flowers hang from the knots of their hair, and Sirisha flowers decorate their ears. In the monsoon Kadamba flowers glorify the heads of these charming women and they carry pink lotuses in their hands."

Even now the charming women of Maharashtra use flowers in their coiffure, and wear bracelets of jasmine round their wrists. Garlands of jasmine, and bela are popular all over India during summer, for we have always had a sensitive appreciation for the fragrance of flowers. While Europeans feasted their eyes on their gardens, and developed beautifully coloured flowering annuals, Indians packed their gardens with sweet-smelling flowering shrubs and trees.

Two thousand years ago, our ancestors led a joyous life. Vatsayana, in his well-known book *Kamastura*, the great book of Hindu Aesthetics written about 300-400 A. D., describes how they enjoyed civic life. The book has a happy materialistic outlook with none of the other-worldly pessimism. Lovers preferred the canopy of the open sky in the night for their revels and selected shady corners in gardens as love-nests during daytime. The woman made a bed of leaves in a secluded nook, and covered it with a carpet of flowers, thus preparing the 'Couch of Love'. Jay Dev in his *Geet Govinda* wrote ecstatically about the divine bliss enjoyed by Radha and Krishna in the shade of trees on a carpet of flowers.

Shakuntala

Kalidasa describes the beauty of Shakuntala clad in tree-bark and decked with garlands of flowers. She meets her lover Dushyanta under the shade of an Amaltas tree laden with golden yellow flowers. Her ivory-like body is draped in garments prepared from the bark of trees and her graceful thighs resembling the stem of a plantain in shape and smoothness, are dimly visible from beneath her scanty primitive drapery. Her throat is like a white lily, and her coy smile reveals her white pearl-like teeth. Wreaths of white jasmines are twined in tresses of her jet-black hair, and lying on a bed of white jasmines under the Amaltas tree, she was a sight for the gods. When Dushyanta comes to her, her rose-petalled lips quiver with joy, and her dark fawn-like eyes are filled with passion. What a charming woman, what a flame-like beauty! The air is filled with the rich fragrance of incense floating to the lover's nest from the hut of Kanva Rishi, and pink lotuses stand out on tall stems in the

lake in front of the lovers. The winds are heavy with the rich odors of gardenias, and the lovers, absorbed in each other, are lost in a world of erotic sensations.

Women learnt the art of arranging flowers on the floor in beautiful geometrical patterns, of weaving garlands, and preparing perfumes. Perfume of sandal was poured into the bath, and the rich people used to dip in this odorous water and came out fragrant and pleasing. In the famous drama of Kalidasa we read about khas-scent being put over the breasts of Shakuntala while on her wrists was a loose bracelet of the stem of lotus (*Kamalnal*). Cool and fragrant sandal-paste was rubbed on the forehead, and bouquets of flowers were placed in rooms.

In those days danseuses like Vasantasena were held in high esteem, and courtesans and demimondes of Pataliputra, Kosambi, Taxila and Vaisali enjoyed considerable patronage from the ruling classes. Some of them kept wine shops in gardens and doled out *Sura* liquor to their admirers from the windows of their garden shops which were decorated with flowers. In one of the windows would sit a beautiful girl playing a vina and singing a passionate song in a melodious voice, harmonising with the vibrations of the vina strings.

Four Types of Gardens

Four kinds of gardens are described by Vatsayana: *Pramadodyan* for the enjoyment of kings and queens ; *Udyan*, where the kings passed their time playing chess with their courtiers, enjoying the dance of danseuses and the jokes of court jesters ; *Brikshvatika*, where the ministers and courtiers made merry with courtesans and *Nandavan*, dedicated to lord Indira.

Vatsayana recommends the building of a house close to a pond with an *Udyan* garden outside. Lilies and lotuses were grown in the pond. Geese, ducks, and swans were also kept in these ponds. In the garden attached to the house, a swing was invariably set up from the thick branches of a shady neem or a peepal, and in the stifling monsoon weather when there is oppressive heat before the coming of rains and there is not a breath of air, these swings were especially popular. The dry and hot months of May and June were spent in darkened rooms inside houses, and in Asar and Bhadon (July to September) during the rains, the people mostly lived, worked and enjoyed life under the shade of trees.

The gardens were kept alive with parrots, *Mynas*, and *Chikors* swinging in cages from the branches of trees. The mango-groves echoed the pleasing notes of the *Koel* warbling "Too-o, Too-o" from morning to evening and the shrill cries of peacocks which displayed their gorgeous iridescent feathers in a fan-shaped array. *Papeehas* kept shouting "Pi-Kahan, Pi-Kahan" from sunset to early dawn, awakening sympathetic responses in the hearts of the love-sick swains playing on flutes, wandering in the forests in search of their sweethearts.

People mostly lived in the open, except for a few months when the hot winds blew, or in winter when it was cold at night. This outdoor life was responsible for the neglect of the house, which was used more as a store-house than a dwelling place decorated with pictures and beautiful furniture. This explains the drabness of the interior of an Indian home, which is richly ornamented outside with a colorful and glittering facade, while the interior is often dismal and gloomy.

Sacred Trees

Most of the flowering trees which grow in India were sanctified by the Aryans. The Kadamba is associated with Sri Krishna, and the Asoka is dedicated to Kama Deva, the god of love. The scarlet flowers of the Dhak trees, the Flame of the Forest, are sacred to the Buddha, and the red cup-like flowers of the Silk-Cotton Tree are sacred to Shiva. The white flowers of Kachnar are sacred to Lakshmi, the goddess of wealth and good fortune, and blue lotus is the symbol of Vishnu, her consort. Amaranth is sacred to Kali.

The golden-flowered Amaltas indicates prosperity in trade and is a favourite of traders and merchants. Trees are also indicators of soil and climate. Palash grows on saline soil only, and Kaitha indicates good climate.

Even now some of these trees are grown near temples by hermits who usually chose for their huts beautiful sheltered sites on the high banks of rivers. Such hermitages are found along the banks of the Ganges and other sacred rivers near ferries, and are sometimes relics of ancient Hindu gardens. Sometimes we find rare trees in these groves of hermits. Mrs. Villiers Stuart discovered such a grove near Khandala, called "Lanoli Grove" on the railway line between Poona and Bombay, a relic of an ancient Buddhist shrine. Sir George Birdwood discovered a white variety of *Erythrina indica* from a similar place at Chembut on the island of Trombay, opposite Salsette.

In these gardens of the sadhus, we invariably find orange patches of marigolds and cosmeas framed by clumps of green and yellow bamboos. These groves, unfortunately, are in an incredibly shabby state these days. Flowers are essential for the Hindus in their morning worship. They must, however, be grown in the devotees' own garden, for there is no merit in offering flowers grown in the garden of another person. The custom of use of flowers in worship was borrowed by the Chinese and Japanese from India.

Yakshas

There was a common belief in Hindu India that trees too had their guardian spirits, the Yakshas and Yakshinis. In fragments of railing pillars from Mathura we see these Yakshas under mango trees. Trees were commonly regarded as symbols of fertility. There is a story in the *Mahabharata* of a mother and her daughter who embraced two trees and thus

became mothers of Viswamitra and Jamadagni. Banyan trees were in special favour with those who wanted the boon of children. In the *Dummedha Jataka* it is mentioned that people worship the devata of a banyan tree for sons and daughters, honour and wealth. In the *Hatthipala Jataka* is the story of a poor woman with seven sons who says: "I prayed to the deity who lives in this banyan tree, and he answered my prayers by giving me these boys." Similarly the peepal tree was also worshipped by women desirous of children.

Seasonal Festivals

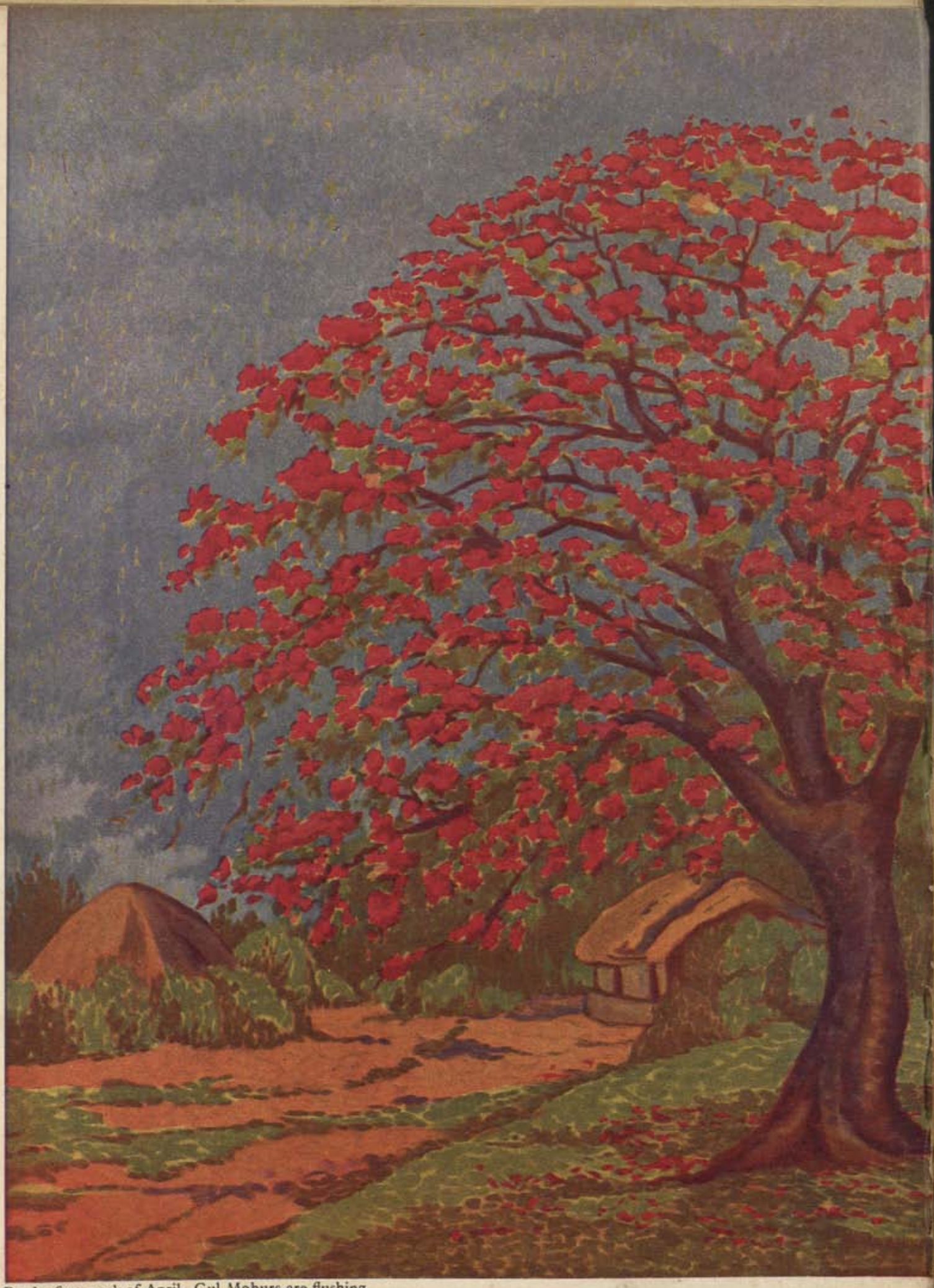
India enjoyed a long spell of peace under the benevolent rule of the Guptas and other Hindu dynasties People led a comparatively happy life and celebrated seasonal festivals with great merriment. The *Salabhanjika* (Woman and Tree) festival was celebrated with great zeal in the ancient city of Sravasti, which flourished in the present-day district of Gonda, and the Sal tree in full blossom was worshipped for offspring.

The merriest festival in ancient India was the *Suvasantaka*, the spring festival celebrated in honour of Kama Deva, the god of love. Dancing, singing and merry-making was organized in every village, and both men and women participated. *Suvasantaka* survives in the form of *Vasant Panchami* which usually falls in the first week of February when the *Sarson* flowers. Women wear yellow saris and men don saffron turbans glorifying the yellow colour of the *Sarson* flowers. Young women carry new-grown corn as offering to the goddess of spring, and set afloat myriads of lighted earthen lamps in the sacred waters of the Ganges and the Jumna. This ceremony of *Deep Dan*, the offering of lamps, is very picturesque: a pitch dark night, dark figures of devotees in a boat silhouetted against the spires of temples, and a meandering procession of lights on the surface of the water gently swayed by the current of the river following the bends of the main-stream, gracefully floating down and vanishing in the horizon. The flickering points of light are thrown into varying geometrical patterns. Some burn fiercely, others glow gently, but all are ultimately swallowed by the angry waves of the Ganges. How symbolic of the lives of individuals is the *Deep Dan*!

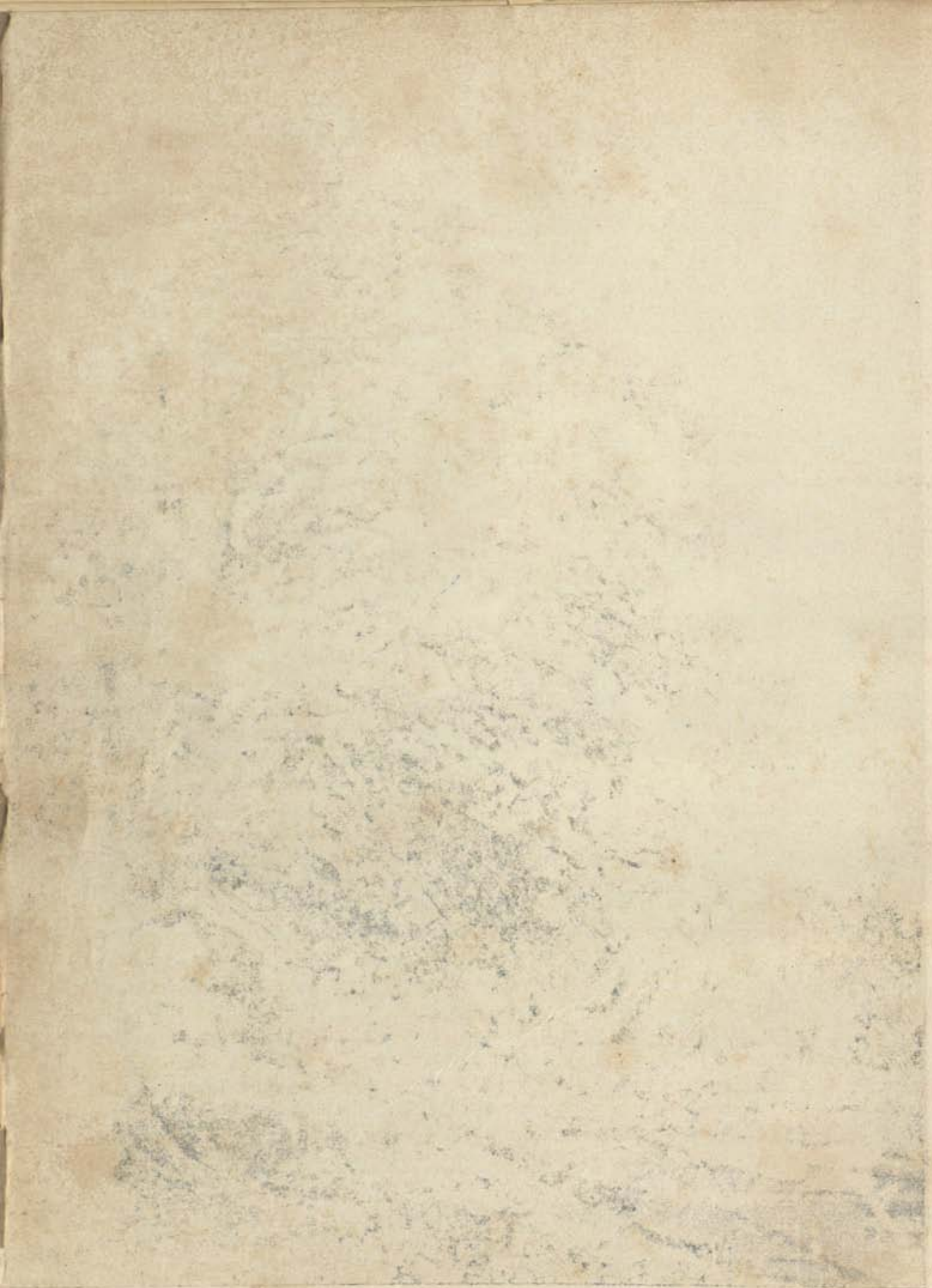
In Kashmir, festivals of flowers, such as the Festival of Roses and the Lilac Viewing Festival are still observed. Large crowds of people in shikaras and boats of all kinds come out to view the mauve flowers of the lilac bushes along the sides of the Dal Lake. When the bright tulips and white and yellow narcissus flowers fade out, people go to the Shalimar Gardens to see the roses in their full glory.

The Indian Spring

Some people, particularly foreigners who are compelled to live in this country, sometimes wonder if there is a spring season in India. They



By the first week of April, Gul Mohurs are flushing into vivid scarlet.



are only conscious of the abnormal heat of the summer months of May and June when the vegetation is scorched by hot winds, the earth looks parched and the sky is one flaming sheet of copper. Yet in India we have a spring season and a delightful spring too. It is heralded by the yellow flowers of *Sarson*, which wave like a sea of gold in the first week of February. Out of our flowering trees the Kachnars are the harbingers of spring. In the third week of February their dark leafless branches produce a harvest of pink, white, and purple-mauve flowers, and for full one month they add color and charm to our landscape. A mixed avenue of pink, purple, white and light magenta bauhinias is a lovely sight. The delicacy of their tints and their mass flowering in a leafless condition produces a display of delicate hues, soothing to the eyes and fills one's heart with bliss. Bauhinias are followed by Semal, the silk-cotton tree, which reminds one of the goddess Lakshmi with numerous arms, holding scarlet lamps in the palms of her out-stretched hands. The leafless branches of this graceful tree get covered with cup-like scarlet flowers which look like crimson tropical parrots. A chattering crowd of *mynas* and crows assembles around the flowers, greedily devouring their petals.

By the middle of March our spring season is at its height. The air is full of the sickening fragrance of mango blossoms. The Asoka gets covered with orange and scarlet bunches of flowers. Spathodeas are ablaze and dazzle in brilliance. The twisted Dhak trees unworthy of notice in winter, shed their trifoliate leaves, and their gaunt and bare branches get covered with dark brown buds which burst into a flame of orange-scarlet blossoms. It is truly the flame of the forest! Clad in the glimmering scarlet bridal robes of spring flowers, vast areas of waste land are lit up with scarlet glamor. When the Dhak is flowering the Holi festival is celebrated. About the middle of March most of our flowering trees blossom and the Indian spring is at its height. There is warmth in the air, and one feels relaxed and happy. Singing and merry-making is organized in all towns and villages. All restraint is thrown to the winds, people sing erotic songs and colored water made by soaking the flowers of Palash and Kusum in water is thrown on each other. Lovers smear each other's faces with red vegetable dyes mixed with powdered mica, affording opportunities for tactile sensations taboo on other days.

By the first week of April most of our trees produce new leaves and the Pakur trees covered with coppery leaves appear charming. Nights are very pleasant and in damp places myriads of fire-flies one seen twinkling like stars "and weaving aerial dances in fragile rhythms of flickering gold." Villagers burn piles of dried leaves under Mahua trees in weird bonfires. The air is heavy with the fragrance of the neem and sirisha flowers and quiet of the night is disturbed

by the rattling noise of sirisha pods. In the rays of the morning sun, the rust-red young leaves of mahuas captivate the soul. Jacarandas are producing their panicles of blue-mauve flowers and gul mohurs are flushing into vivid scarlet. It is getting warm, and the Indian spring has ripened into summer.

CHAPTER 20

Persian and Moghul Gardens

THE inhabitants of Iran and Central Asia have an intense love for flowers. The most popular themes of Persian poetry are the love of the bulbul for the rose, and the beauty of the spring. In the highlands of Turkestan and northern Iran, the spring is intensely colourful. After the winter snow melts in early March, the valleys get carpeted with flowers, and the pink blossoms of almonds and apricots and the silvery sprays of plums produce a scene of joyous splendour. Then hot winds follow and scorch the vegetation. Though the spring is all too brief, it leaves an indelible impression on the minds of the people who console themselves for the rest of the year by composing and reciting poems in praise of the rose, the tulip and the narcissus. The transitory nature of the Persian spring has affected the very outlook of the Iranian people on life and the universe, and encouraged that strange mixture of hedonism and pessimism with which the western world became familiar through Fitzgerald's translation of Omar Khayyam. It is thus that Omar Khayyam describes the ephemeral glory of the Persian spring, and the transient nature of life itself.

"Alas, that spring should vanish with the Rose!
That Youth's sweet-scented Manuscript should close!
The Nightingale that in the Branches sang,
Ah, whence and whither flown again, who knows!

And again—

"And look—a thousand Blossoms with the day
Woke—and a thousand scatter'd into Clay:
And this first Summer Month that brings the Rose
Shall take Jamshy'd and Kaikobad away.'

While they realized the insignificance of man in the immensity of space and the universe, comparing him to a bubble in a vast ocean, they did not preach asceticism and renunciation of the world. Though life is merely a bubble in a vast ocean, they made it an iridiscent bubble, for they took the advice of Omar seriously when he said "While you live, drink! for once dead you never shall return." They enjoyed their leisure in beautiful rose gardens, with running water sipping grape wine which "clears today of past regrets and future fears". Rose was their favourite flower here as well as hereafter, and Omar expressed a desire to be buried in a spot where the north wind may scatter rose petals on it. His wish was fulfilled, and when he died in 1123 A. D. he was buried in a sweet garden-side at Naishapore with roses dangling over his tomb. This shows how the people of Iran loved flowers and their beautiful gardens. Saadi, the poet of Shiraz named his book of verses as "Gulistan and Bostan" i.e., the "Flower Garden and the Fruit Garden." Only an author who lived among people who admired flowers and gardens would select a name like that for a book, which was his life's work

Persian Gardens

The flower garden originated in Iran. Even now love for flowers persists among present day Persians. Some parts of Iran, particularly in the north are well served by fresh-water streams and rivulets, and people make use of their water for growing trees and flowers. It is rare to find a house without a garden in Iran, and even poor people brighten the compounds of their houses with roses, tulips, and marigolds. Squarish or rectangular shady arbours made of bamboos are commonly seen in the court-yards of houses, and on these are trained creepers like rambling roses, grapes, and petraeas. In these bowers the family assembles for tea, and daily gossip, and women spend their time on needle-work and embroidery, and the tedium is punctuated with juicy bits of local scandal. In bigger houses with spacious courtyards a lily pool (*Houz*) is commonly constructed in the middle and flowering plants are grown around it. Gold fishes are also bred in these pools.

Of all the flowering plants, the rose is the most popular with the Persians and they grow numerous varieties of this shrub. Their other favourites are tulips, marigolds, violets, marvel of Peru, daffodils, poppies and narcissus. At present nearly all the European herbaceous annual flowering plants are grown.

Unlike the Moghul gardens, the Persian gardens have no high boundary walls. Great regard is paid to symmetry in these gardens, and a cypress is

White Bauhinea is a symbol of youth and purity.

naturally a favourite. White poplars, plum trees, udai (*Acacia planifrons*), and weeping willows are also common. Weeping willows are grown on canal banks. There is a beautiful garden in Meshed, known as 'Maidan-i-Arak' in which the names of famous poets like Saadi, Hafiz, and others are composed out of flowering annuals. Some of the flower-beds are very cleverly and artistically laid out and when in full bloom serve as models for designers of carpets.

The New Years' Day (*Nauroz*) in Iran falls generally on 21st of March, when almonds, apples, apricots, plums and pears are blossoming. Crowds of merry-makers collect in the public gardens and orchards to enjoy the sight of blossoms and watch the trees dressed up in white. and pale-pink hues. *Nauroz* in Iran is truly a day of rejoicing and merry-making.

Moghul Gardens

In India a garden in the sense of enclosed space grown with plants for the sake of the beauty of their flowers is a gift of the Moghuls and their Persian soldiers and courtiers. Babar, the first Moghul emperor, introduced gardening technique of Central Asia and Iran in India. The begums of the Moghul emperors also share with their husbands the honour and glory of creating the famous gardens of Kashmir, Punjab, Delhi and Agra. Babar's wife, Mahum influenced the creation of Bagh-i-wafa and Bagh-i-Kalan and of Ram Bagh on the banks of the Jamuna at Agra. In his memoirs which he named 'Bagh-i-wafa' (the Garden of Fidelity), Babar has given an account of his gardening activities. He describes the gardens of Samarkand and Kabul, and also mentions the new plants he saw in India.

Jahangir, and his Persian wife Nur Jehan, made the gardens at Shahdra Lahore, Wah and Hassan Abdal. Ali Mardan Khan, one of the nobles of Shah Jahan's court, designed the Shalimar Bagh of Lahore as well as the gardens in the Red Fort of Delhi and the Taj Mahal of Agra. He also introduced in Kashmir the chenar tree from Central Asia. The chenar has become the national tree of Kashmir and its leaf design can be seen in embroidery, carpets, wood-carving and even in brass-work. Like deodar in Kumaon, chenar is a state tree in Kashmir and no one can cut it without the permission of the government. It is on account of this protection that we still see avenues of stately chenar trees along the banks of the Jhelum in Srinagar and near Matan on the road to Pahalgam.

Fadai Khan's Garden at Pinjor

The well-known Moghul garden at Pinjor near Kalka, on the hill-road to Simla, was built in the reign of Emperor Jahangir by Fadai Khan, a Moghul general. The old name of Pinjor is Panchpura—the town of five Pandava brothers. The tradition is that the Pinjor spring was discovered by the Pandavas, during the period of their exile. After victory over the Kauravas, and many years of empire, the Pandavas renounced the world and proceeded towards the Himalayas. Four of the brothers settled at Pinjor, while Yudhishtra,

the eldest, travelled on towards Mount Meru followed by his faithful dog. After lapse of many centuries, the possibilities of the Pinjor spring were grasped by the garden-loving Moghul, Fadai Khan. The garden is so situated that it embraces wide views of the Kasauli hills and the Siwalik range. The sloping nature of the ground, and the presence of a bubbling perennial stream were possibilities which immediately appealed to the Moghul, who utilised them to their best advantage.

Fadai Khan built his country-house and garden at Pinjor with all haste, but could not enjoy its calm and beauty for long. The hill Raja, in whose territory Pinjor was situated, did not like the idea of a powerful Moghul general settling so close to him. The tract of land stretching from Pinjor to Mani Majra, known as Neli, is notorious for large incidence of cretinism and goitre among its population. The Raja collected all prize idiots, and goitre-affected women of Neli and sent them as domestic servants to Pinjor garden. When the begums of Fadai Khan saw so many women with swollen throats, they were rather taken aback and on questioning them were told that, if they continued to stay in that place a few months more, they would also look like them. The begums became scared, terribly scared. On the behests of his terrified begums, Fadai Khan quitted Pinjor, leaving the garden to Raja of Bhiwana. A Raja of Sirmur acquired it from the Raja of Bhiwana, and ultimately sold it to Maharaja of Patiala. *Its present owner Maharaja Yadvindar Singh, a keen gardener and lover of plants, has greatly improved this ancient garden.

As one crosses the Ghagra nadi near Surajpur, the road rises gently and bends sharply. Dhak trees laden with crimson flowers and amaltas trees covered with yellow bunches enliven the landscape. On the left side of the road, a grim-looking fort-like building with crenellated walls can be seen. This is the Pinjor garden. Fluttering over the entrance gate, is the saffron flag of the Patiala state. The white-washed gate is smothered with magenta-coloured Bougain-villaeas. Flanking the canal, are stately avenues of the Royal Palm, *Oreodoxa regia* with their graceful plumes waving gently in the morning breeze. There are six terraces in this garden with a canal running through. At the end of the first terrace is a white building called Shish Mahal, which appears like a huge transparent shell against the dark blue evening sky. Shish Mahal is furnished in simple Indian style, and is used by the Maharaja for his residence when he visits Pinjor.

At the end of the second terrace is a two-storeyed building called the Rang Mahal, flanked by the guest houses of the Maharaja. When water is running in the canal, fine views can be had from the Rang Mahal. The water flowing beneath the Shish Mahal falls over a projecting ledge, below which the wall is painted blue, and is carved into rows of alcoves in which earthen lamps,

filled with sarson oil are lit and twinkle like fire-flies, creating illusion of a fairy land. The fountain throws up jets of water many feet high, which break into fine spray. The lights of Surajpur and Kalka twinkle like stars, and the air is heavy with the fragrance of *Raat-ki-Rani*. In summer subtle yellow jasmins intoxicate the senses, and snow-white moghra flowers bloom most sweetly. Borders of phlox, verbena, candy-tuft, and pansies present a colourful pattern, pleasing to the eye. Under the dark mango trees, are soft patches of blue ageratum. A visit to Pinjor in spring, when flowering annuals are at their best, water is flowing over blue cascades, and the fountains are in full play, is an event never to be forgotten. Pinjor is truly the most beautiful garden in northern India.

Moghul Garden Design

Garden architecture is influenced by the climate of the country, and its political, economic, and social environment. A typical Moghul garden is squarish or rectangular in shape. It is surrounded by a high wall adorned with serrated battlements, and there is a stately entrance gate with huge wooden doors studded with heavy iron bosses, nails and spikes. The garden itself is divided into two or more terraces with a small brick-paved canal with running water flowing down through tanks fitted with fountains. A high protecting wall was a necessity in those insecure times in Central Asia, as an enemy or armed brigands might pounce upon the chieftain at any time. Surrounded by his wives and concubines the Moghul chieftain sought peace and shelter in his garden, secure against his enemies, and from the curiosity of peeping Toms. The garden wall also protected the inmates from the hot winds of summer, and the plants from the desiccating effect of burning sand and hot air. Central Asia has undergone gradual desiccation in the last twenty centuries or so. Green valleys slowly became sandy deserts, and vegetation receded into smaller and smaller areas before the onslaught of sand. Man struggled heroically against his enemies, the hot wind and the sand, and one of the devices which he adopted was that of raising high walls to protect the trees and springs of water.

Running Water

The love of a people living in a semi-desert for cool running water can easily be appreciated, so much so that the Arab populated his paradise not only with houris, but also imagined that it is a huge garden-like place with streams of cool crystal-clear water. The idea of heaven as evolved by different peoples living in different zones of the earth, crystallises their desires and strongly-felt needs. While the sport-loving Red Indian visualized his heaven to be a huge open area, with plenty of horses and deer, the Eskimos' heaven is full of lichens and reindeer. The heaven of the ease-loving Hindus is populated with fairies who sing and dance in Indra's court all the time, and the heaven of the Palestinian Jews and Christians who tended goats and sheep is a pasture land with streams full of milk and honey. No wonder the Arab and the Persian living

in a more or less arid desert imagined his paradise to be a huge garden where he would lie languidly on grass with a beautiful woman at his side, listening to the music of running water and enjoying its delightful flash and sparkle. Water is the life and soul of a garden. As Mrs. Villiers Stuart observes "The spirit of the garden-paradises of Europe hides in the flowers, the grass, the trees, but the soul of an Eastern garden lies in none of these ; it is in the running water which alone makes its beauties possible." On account of their love for running water, the Moghuls selected sites centring round hill-side springs for their beautiful gardens in Kashmir, like Verinag, Achhabal, and Nishat. They borrowed from the Persians the idea of constructing canals and tanks in such a manner as to keep the water brimming to the level of the paths on either side. Like the Persians, they also paved the shallow channels of water with brilliant blue tiles, which give a suggestion of depth, and reflect the blue sky in a deep blue tone. From terrace to terrace the water was led down the beautiful slopes, called chadars. Mrs. Villiers Stuart who has made detailed observations on Moghul gardens, thus describes these chadars—"These marble or stone chutes were carved in various patterns, cut ingeniously at an angle so that the water running over them was thrown up and broken into ripples and splashes. Shell and wave designs were the favourites, and their name was as prettily fashioned as their carving—they were called "chadars," meaning white "shawls" of water. These water-chutes are a very characteristic feature of the Moghul gardens, and were used with much effect where the ground allowed of the garden being laid out in a series of high terraces. But, in small gardens or in the plains, even the slightest slope was made use of ; only a foot or two of difference sufficed to create one of these charming little water-falls, whose inspiration was directly drawn from memories of the dancing spray and white foam of mountain rivulets in the builder's northern home."

The Terrace and Baradari

The Moghuls made their buildings and gardens in a grand style. Compared with their forts at Agra and Delhi, the castles of feudal Europe appear mean little structures, and placed beside Moghul gardens at Srinagar and Lahore, though they are shorn of their original glory and beauty, the Tudor gardens of Hampton Court Palace, appear tawdry. There is more than mere national pride in the remarks of an Indian visitor, who comparing the Moghul and English gardening said to Mrs. Villiers Stuart—"You English can grow plants and flowers to perfection and many that we never knew to exist before. But why can't you design a garden to grow them in ? Look at the gardens our kings and princes made before you came." The Moghuls concentrated their attention on garden architecture and produced beautiful designs, while the English paid more attention to plants, and by scientific study of their growth and mode of reproduction evolved many new varieties of flowering annuals. In its own

place the contribution of both to world gardening is great. It is thus that men came to build stately and to garden finely.

As the Moghuls came from a hilly country, the idea of building a garden in terraces came to them naturally. They were so much enamoured of the terrace garden that they imported it even in the flat plains of the Punjab. Sometimes there are eight terraces corresponding with the eight divisions of the paradise according to Moslem faith, or seven to symbolize the seven planets. The Taj gardens follow the fourfold field plot plan, the ancient Hindu fourfold paradise of peace and repose. The Nishat Bagh by the side of Dal lake was built by Asaf Khan, a brother of Nur Mahal. It is built in twelve terraces, one for each sign of the Zodiac, which rise from the bank of the Dal lake and ascend up the mountain-side.

"Baradari," a canopied building with twelve open doors on all sides, often many more, is another feature of some of the Moghul gardens. "Baradari" is a typically Hindu structure evolved by them to meet the requirements of the rainy season. People sit in baradaris to enjoy fresh breeze, and to watch the black curly clouds and the rain. In Rajput and Moghul paintings we often see princesses surrounded by slave-girls watching the flights of white egrets, with their snow-white feathers contrasting with slate-blue clouds in the back-ground. In the cold temperate climate of northern Europe, particularly in England where rain is usual and sunshine is rare, people cannot imagine the joy and pleasure which the first monsoon showers bring to the young and the old alike in the parched plains of northern India when the hot sun of June scorches all vegetation. To them, these Indian pictures appear funny, as they cannot imagine that any one can be so balmy as to like rain and clouds, which they always associate with bad weather. Indians love the monsoon rains and clouds. In their baradaris they listen to the songs of the dancing girls, watch rain and clouds, and suck mangoes cooled in iced water. It is hardly to be wondered that the Moghuls adopted the baradari in their gardens in the plains. They painted the masonary pillars of baradari with their favourite design of bouquets of flowers in vases, and furnished them with thick carpets and cushions.

The design of the small plots along the canals and tanks was formal, and we usually see octagons or star parterres which were filled with flowers, separated by oblong beds planted with two orange trees on the sides of a cypress tree.

Flowers and Trees

Bricks and mortar by themselves do not make a garden. It is the trees, shrubs and flowering herbs which give life and soul to it. Most of the Moghul gardens are in a neglected state at present ; the canal and tanks are choked with blue-green slimy algae and the trees which were originally planted have mostly died. Those who have experience of gardening know well enough what

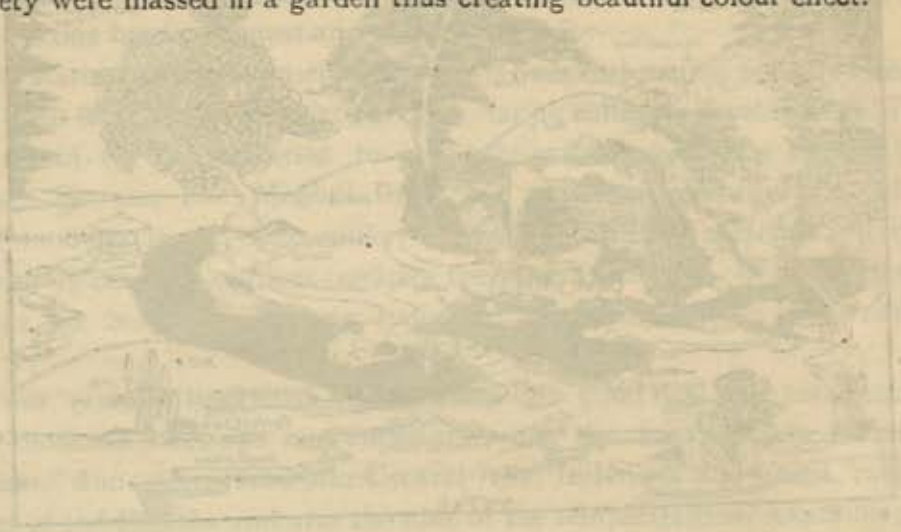
even a year's neglect can mean to a garden, and what efforts are required to make a garden. So one can imagine the transformation the Moghul gardens have undergone in the last three centuries.

Details of plants grown by the Moghuls are available from the autobiographies left by the Moghul emperors. They planted mixed avenues of cpyresses and flowering trees like the white flowered variety of *Bauhinia variegata* or orange and lemon trees. In Kashmir, plum or apple trees were grown in place of oranges and kachnar. Bordering the square plots were pomegranates and oranges. Oranges, pomegranates, almonds, plums and white kachnars are the symbols of youth and life, while cypresses symbolize death and eternity. The dark-green cypresses, the emblem of death and eternity provided a solemn background to the silvery sprays of plums and pink blossoms of almonds, the emblem of youth, life, and hope. Thus, we see life, and hope jostling with death and eternity, reminding one of life force, ever renewing itself and ever rejuvenating by reproducing young life and lopping off the cankered, the aged and the decaying.

The mysticism of the Orient finds expression even in the garden-craft. In Japanese gardening Wistaria is likened to a woman, frail, drooping sweet-scented, robed in delicate pale hues, clinging helplessly to her lord and master the Pine, a symbol of long life, sturdiness, strength and steadfastness. The white plum blossom is symbolic of spiritual strength and beauty, while the pink cherry blossom signified bodily or sensuous beauty. In Islamic garden-craft, too, we find rich symbolism in the planting of trees, and flowering herbs. Describing the symbolism of Moghul garden-craft, Mrs. Villiers Stuart writes, "The Moslem garden-craft, like Moghul painting, is full of symbolism, and rich with all the sensuous charm and dreaminess of the old Persian tales; and the story of Laila and Majnun, the faithful lovers who only saw each other twice on earth, is most frequently commemorated in the garden. Two low-growing fruit trees, such as lemon and citron, or a lemon and orange tree, planted in the midst of a parterre of flowers, are the lovers happy in paradise; the same idea is also illustrated by two cypresses or the so-called male and female date palms, which are generally planted in pairs. The design of the double flower-beds in which the two symbolic trees were planted can be seen in the brick parterre at Lahore and in those of the Taj. Majnun's sad, earthly symbol is the weeping willow (*baid-i-majnun*), whose Laila, the water lily, grows just beyond his reach. Two cypress trees are frequently grown as their emblems, and the prettiest and quaintest emblem of all is Laila in her camel litter, a rose-bush on a little mound. Dark purple violets represent the gloss and perfume of her blue-black hair, saman (jasmine), which also means a foaming stream is Laila's round white throat,

"cypress-slender" is her waist, tulips and roses are her lips and cheeks and the fringed, starred narcissus her eyes."

The Moghuls mostly planted spring-flowering trees, shrubs and herbs in their gardens. They grew white, purple and mauve iris near lilac bushes, daffodils and narcissi under apple and quince trees and tulips under pear and plum trees in their Kashmir gardens. In summer they grew roses, carnations, jasmines, hollyhocks, peonies, and delphiniums. Sometimes flowers of one variety were massed in a garden thus creating beautiful colour effect.



CHAPTER 21

The Japanese Garden

STRANGE as it may seem the Japanese garden, the most beautiful and highly developed of all present day gardens, in whose praise westerners have written so much, has its roots in the Indian soil. India exported Buddhism to the Far East as well as the Buddhist temple garden. The history of the development of culture and civilization shows how peoples and countries borrowed ideas from one another and transformed and developed them according to their own peculiar environment and needs. All nations and peoples, including the fair-haired, blue-eyed 'Herren-volk' of Hitler are borrowers as well as creators of science and culture, and we cannot take the extreme view that the Japanese alone are imitators. We are all imitators as well as originators. If the human race had not so many imitators, all progress would have come to a stand-still long ago. The so-called western science is only western in the sense that it developed in its later stages more speedily in the countries of the West, where conditions for scientific inquiry were more favourable in the last two centuries as compared with authority-ridden countries of the East, which had become stagnant back-waters and whose people had lost that elasticity of mind under the dead-weight of so called religion and priest-craft. All the same it would be short-sightedness on our part, if we forget that modern science has its roots in the Astronomy and Mathematics of the ancient Hindus, and in the Alchemy and

Algebra of the Arabs. The Greeks borrowed their science from the Egyptians, the Egyptians from the Assyrians, the Arabs from the Greeks and the Hindus, the Western Europeans from Greeks, Romans and the Arabs, and the Americans, the Japanese and theRussians from the Western Europeans. And, the process goes on, on a much greater scale with the development of speedy modern means of communication like the aeroplane and radio, and eddies have started even in the back-waters of China and India. Science, culture and civilization grow like snow-balls, and the snow-ball collects more mass as it rolls along, not only gaining in volume but in richness and variety as well.

The state of civilization of a country is judged by some persons from the amount of soap used by the population. So far as cultural development is concerned it would be more correct to judge the cultural level of a country from its gardens. By this test Moghul India had achieved a very high cultural level, and modern Japan, too, ranks fairly high in the present-day world. England with its beautiful gardens occupies the place at the top, while continental Europe lags far behind, and we in India lie almost at the base of the cultural pyramid.

In our present backward state it gives us a good deal of satisfaction that a couple of thousand years ago our ancestors were the torch-bearers of culture and progress, who adventured into Central Asia, Indonesia and China, carrying the message of the Buddha and also the idea of the temple-garden. Describing the history of gardening in the Far East, Mrs. Villiers Stuart writes :—

"The Indian Buddhist garden, forgotten in the land of its origin, still survives further East, although so transformed and tinged by the genius of another climate and another people, that the garden history of the plum and cherry trees, the wistaria and morning glory, the lotus and the Japanese iris, is often misunderstood and overlooked. For all that, the Japanese garden, the most intimate and charming expression of Japanese nationality, came like so many of their arts, from India through China and Korea. And from the early temple gardens made by the Buddhist monks and pilgrims, the whole beautiful and elaborate system of Japanese garden craft has gradually been built up. The Indian Lotus-bearers reached China both through Turkestan and by the Southern route through Burma and Cambodia, and 'Coal Hill,' near Tatar city in Peking, is a relic of the Pleasure Hill idea. The style is supposed to have been introduced into Japan in the sixth century by one, Yohan Loan Han, who constructed great mounds, some of them a hundred feet high or more, and brought water in conduits to form lakes and ponds. These hills and rockeries were planted after the Indian fashion with flowering trees and shrubs."

The Buddhist temple garden flourished in the soil of China and Japan. In the moist temperate climate of Japan so favourable to the growth of herbs,

shurbs and trees, and in the hands of an artistic people, it evolved till it was transformed into almost a new type of garden. The native genius of the people asserted itself and the Buddhist temple garden developed into the Japanese landscape garden.

Design

The modern Japanese garden is the result of efforts of priests and garden-lovers of Japan spread over a period of eleven centuries. It aims at providing in miniature the composition of a mountain-side landscape with a characteristic cascade, a small lake with an island, a bridge, characteristically arranged stones and rocks, and ornamental stone-lanterns suggesting light. Garden designing was made a part of the ritual of their religion by the priests of Zen sect of Buddhism, and the gardens designed by the Zen priest Muso Kokushi in the early part of the fourteenth century are preserved in Kyoto even now. Where water-supply is deficient, dried up rock gardens are in vogue and sand is strewn to suggest water. There is no massing of trees and a solitary cherry tree planted at a suitable angle against the background of evergreen trees appears far more beautiful by contrast than clumps or avenues. Simplicity is the keynote of such gardens. So far as possible trees are planted in on environment approximating their natural habitat.

However, it would be erroneous to run away with the idea that a Japanese garden consists of a few stones, bridges and stone-lanterns. The basic conception of Japanese garden is calm and peace. It is a place where you come for meditation, a place where you retire to forget the worries of the world, and to escape the hurry and bustle of modern life. As Mrs. Basil Taylour so rightly observes, "The key to the understanding of the difficult, highly involved art of Japanese garden-making is spiritual. It is an art which has for its conscious or unconscious aim the refreshment of the body by raising the mind to another plane of feeling."

You are not expected to hurry through a Japanese garden. The bridges, the stepping stones and rocks are so placed that you simply cannot rush through. The rustic shelters in the shade, the tea-houses, the gold-fish in the pool, the soothing patter of water from the water-fall all tempt you to linger on. You admire the delicate rosy blooms of cherry trees, and you open your heart to the beauty of white plum blossoms which display their lovely flowers against a background of deep green furnished by conifers, like cryptomerias and firs. Guarding the gate of the garden are two venerable pine trees symbolic of long life. Crimson-red azaleas lie bleeding on the rocks, and irises display their beautiful flowers, proud of their glamour as they see thier reflection in the limpid water of the pool. From your seat you watch the flight of birds and contemplate the beauty of delicate camelias and peonies. Delicately coloured flowers follow each other in succession from month to month, and all the year round, there is something to

love and admire. Flowering trees are irregularly placed in happily chosen spots to give the impression of natural landscape. Practically all gardens in Japan are landscape gardens and are reproductions on a small scale of the scenery of Japan.

Water

Water is the life of a garden, Moghul or Japanese. Describing the use made by the Japanese of water, apart from irrigation in their gardens, Mrs. Basil Taylour writes, "The rocks and stones are the bones of the skeleton, the contour of the land represents its features, the flowers and trees are the flesh and the adornments of dress, but the water is the life and soul of the garden. No one knows better than the Japanese landscape artist what compound interest in beauty he reaps by the repetition and reflection of his earthy garden in his watery one. Just as mirrors enlarge little rooms, as the sea beneath a sunset intensifies the glory of the western sky, so water in a garden doubles the interest, the beauty, and apparent size of the place in which it is put."

Pine trees which are great favourites of the Japanese are trained into artistic forms, and lean over the surface of the water in an attractive manner. Sometimes trees are trained into fantastic shapes like sailing boats. Palm trees are grown near houses to enjoy the music of pattering rain drops on their broad waxy leaves. In winter these tropical palm trees are protected by covering them with close-fitting jackets of rice-straw. Great attention is paid to the welfare of the trees, and when fruits are not edible, they are plucked off at an early stage to prevent a drain on the vitality of the tree.

Bon-Sai

The art of dwarfing and transplanting has considerably developed in Japan. There are trees scores of years old which look no bigger than saplings 2-3 years old.

Bon sai, the art of cultivation of dwarf trees has considerable vogue in Japan. Trees are dwarfed by growing in pots and mollusc shells, and they are trained to assume the shape of old trees. Thus the townsman can enjoy the beauty and feel the grandeur of ancient trees in the house, and he can create the atmosphere of the forest in his urban home.

Deciduous trees like cherries are transplanted even when as old as 30 years. When they are in a dormant condition and leaves have fallen they are dug out, the branches are pruned and the trees with as much soil clinging to the roots as possible are transported on huge carts to their new homes and planted. It is not an uncommon sight in the cities of Japan to see people transporting their favourite trees along with their other belongings when changing houses.

In the United Provinces we can see models of Japanese gardens in the Kamla Retreat, the house of Sir Padampat Singhania at Cawnpore. It would be worth-while making full-fledged Japanese gardens in Kashmir where climatic conditions are similar to Japan. In the plains too, small Japanese gardens of

the Gyo style should be made in the principal towns. As a contrast to our Indian gardens, the Japanese gardens have a charm of their own, and variety is the spice of life.

Japanese Flower Symbolism

As in the Moghul garden-craft, we find rich symbolism in Japanese gardening. The white blossoms of the plum are symbolic of spiritual beauty, while the pink cherry blossoms signify bodily or sensuous beauty. 'Saki' is drunk when viewing cherry blossoms, for wine, women and cherry blossoms go together. Cherry blossoms have been popular for centuries in Japan, and Shogun Yoshimura loved this beautiful plant so intensely that he planted ten thousand cherry trees, along the banks of Tamagawa, so that the purity of the flowers may keep water of this river pure, thus safe-guarding the health of the inhabitants of Tokyo Peach is the favourite of little girls who use its flowers in their festivals. Hideyoshi made his palace on a mountain which was planted with so many peaches, that it was called, "Peach Mountain." The Chrysanthemum with the Plum, the Orchid, and the Bamboo constitutes the "Four Floral Gentlemen." With its numerous petals, which appear like sun-rays, chrysanthemum signifies the Rising Sun, the symbol of Japan. The morning glory with its transient beauty typifies all that is brief and beautiful in life. The conifers like firs, pines, and cryptomerias signify long life and devotion, and are planted near temples. All these conifers are regarded as sacred, and are planted in avenues and clumps in the vicinity of the Buddhist and Shinto temples.

Festivals are celebrated in different months when the favourite flowers are at the height of their beauty. In the middle of April, when cherry blossoms are at their best the Cherry-viewing Festival is held. In November, when chrysanthemums are in their full glory, a festival is celebrated in honour of these flowers.

CHAPTER 22

The English Garden

THE English flower-garden is the most beautiful of all European gardens. The typical grass-land climate with showers of rain at frequent intervals, so favourable for the growth of herbaceous vegetation, the wealth of the country with a comparatively large percentage of people earning big salaries and with sufficient leisure at their disposal, and the love of the people for flowers, are factors which have contributed to the evolution of the English garden to its present high level of development. The average Englishman is an ardent lover of flowers, and an English-woman receives a present of cut-flowers with real joy, which she freely expresses in charming encomiums of " How lovely !" That is why florists' shops are so popular in England. It is estimated that about 15 million pounds sterling a year are spent in England, on cut-flowers and over a hundred thousand people are employed in the industry. Carnations, sweet peas and roses are very popular and the palings and fences of houses are invariably covered with rambling roses of numerous varieties, and they are a beautiful sight in the month of March.

The pleasure-garden was originally a gift from the East to the West, which the West has brought back to the East in the highly developed form of the herbaceous annual border. It was in the hot countries of Western Asia that the grouping of flowering plants irrigated by canals and wells which we call a garden, came into existence. We hear of the so-called ' Hanging Gardens of Babylon' which were, in fact, terraced gardens made on mounds. The pleasure-garden

originated in Iran and Central Asia when these countries were comparatively in an advanced state of civilization. The shade of trees and cool water are prime necessities in a hot country. The Persians made pleasure-grounds with shady walks, and planted roses along pools of water to add fragrance to the air. The Greeks copied these pleasure-gardens of the Persians, and the Romans borrowed the garden idea from the Greeks. The history of the English garden is closely connected with the history of gardening in Europe, which may be traced like most of their other arts, from the Greeks and Romans. The art of gardening is said to have been introduced into Athens by Epicurus, the pleasure loving philosopher who used to give discourses to his pupils in his little garden about 300 B. C. The Romans who were well-known gourmands lined their "Digestion walks" with topiary hedges and dwarf trees, and also made fountains in their gardens. With the fall of the Roman Empire, the art of gardening also decayed in Europe. In the Dark Ages prior to the tenth century Europe was dotted with gloomy castles and dismal monasteries. The monks made kitchen-gardens for supplying vegetables to the inmates of monasteries, and developed herb-gardens for medicinal purposes. These purely utilitarian gardens of the monks ultimately developed into flower-gardens and botanical gardens.

In the fourteenth century, the monks introduced gardening craft in England. With the accumulation of wealth on account of trade with countries in Asia, Africa, and America the need for pleasant ways of spending leisure was felt among the moneyed classes in Europe. The utilitarian fruit and vegetable garden of the monastery developed into the flower-garden, of the aristocracy. In the middle of the sixteenth century flower-beds, knot-gardens, pleached alleys, topiary work and terraces were introduced from the continent. Thus, the Tudor garden was evolved, and a typical example can be seen at Hampton Court in Henry VIII's garden. These gardens relied for their effect on architectural features and were, in fact, projections of the palace in the garden subject to the laws of architecture. In the seventeenth and eighteenth centuries the French architectural garden found its highest expression in the Versailles palace gardens of Louis XIV which were designed by Andre Le Notre, who also designed the famous gardens of St. Cloud, St. Germain and Fontainebleau in France, as well as St. James' Park in London. The gardens of Schonbrunn, Wurzburg, Dresden, Peterhof and Fursternberg at Prague are all of this type. In such gardens, parterres are merely projections of the rooms and galleries of the palace. Later on, the parterres became more elaborate consisting of scrolls, arabesques, and the growth of flowers was subordinated to architectural magnificence.

With the increase in maritime trade with foreign countries, and the desire to grow plants of warmer climates like oranges, the hothouse came into being

English Gardens.

about the close of the seventeenth century, and ultimately developed into glass-houses which cover acres of land in the suburbs of London. During this period scientific study of plants, their growth, nutrition, pollination and fruiting was made by pioneers like Richard Bradley, Philip Miller and Fairchild.

A reaction to architectural formality set in about the middle of the eighteenth century, and landscape-gardens with slavish imitation of nature came into vogue under the leadership of Kent, Capability Brown and Repton. Winding paths replaced straight walks, clipped hedges by informal groups of trees and basins by streams. Rivulets and waterfalls were so arranged that they could be seen in long sweeping vistas from the windows of the country houses of dukes and squires.

In the early part of the nineteenth century another reaction set in. People became tired of the landscape-gardens of Capability Brown, and the Victorian garden with formal beds of annual flowers came into being. However, unlike the architectural gardens of Andre le Notre, the architectural features were subordinated to beds of flowers in the Victorian garden. Botanical explorers like David Douglas, and plant-breeders and gardeners too numerous to mention introduced many new varieties of flowering plants and this influx of new plants ultimately broke the formality of the Victorian garden which evolved into the modern English garden with its turf, herbaceous border, shrub garden and rock-garden, in which as Cox says, "A garden is now made to fit the plants, not the plants fit the garden."

In the eighteenth century commercial capital developed, followed by the development of industrial capital in the early nineteenth century, and profoundly affected the structure of society in England, and the balance of power also shifted. Power passed from the land-owning aristotracy to the merchants, bankers and industrialists, the new capitalist classes. In the Victorian period, the middle-class which forms the core of Modern English body politic developed. Most of the landlords and squires could no longer afford big landscape-gardens and private parks. The ascendancy of the middle classes also affected the art of gardening. The park and the landscape-garden made way for the small modern English garden with its rock garden, shrub garden and herbaceous border. It is in its economic and social context that we can understand the true nature of this change.

Turf and Herbaceous Border

Turf and the mixed border of herbaceous annual flowering plants, are the contribution of the English gardeners to gardening. Our parents were only familiar with marigolds, amaranthus, and a few vincas; and it was the English official and his garden-loving wife who introduced phloxes, verbenas, and so many other annuals in the gardens of India. On account of our hot and dry summer which burns all grass, the English turf is always an object of envy for us in the

plains of northern India. All the same, we appreciate well-kept spacious lawns: in winter on account of the setting which their green grass provides to annual flowers and in summer for its own sake, for there is nothing so pleasant to sleep on, than a lawn with a cleas sky overhead in the hot months of May and June, when the freshly irrigated grass in the lawn is many degrees cooler than masonary verandahs and roofs of houses.

Herbaceous Border of Annuals

On account of frequent showers the climate of Great Britain is ideal for the growth of herbaceous annuals and their gardeners have produced a large variety of annuals by selection and hybridisation. Moreover, the ardent English collectors have collected flower seeds from all parts of the world, and we can see even the rare Himalayan Blue Poppy in some select gardens of England.

There are three principles underlying the making of a herbaceous border of annual flowering plants. *Firstly, the plants should be transplanted with due regard to their ultimate height in the beds;* the tallest like dahlias, antirrhinum, clarkia, larkspur, linum, sweet-sultan and corn flower at the back, the medium-sized plants like ageratum, carnations, arctotis, wall-flower, lupins, anchusa, salvia, and asters in the middle, and dwarf plants like pansies, phlox, verbena, gamolepis, alysum and candytuft in front. The plots in the bed should be slightly irregular, so that dead geometrical symmetry does not result, and there is a harmonious blending of all the plants. The bed should be at least 12 feet wide, as narrow strips do not allow full scope for the display of annual flowers to their best advantage. *The second principle is that of colour blending and colour contrast* yellow gamolepis, platystemon and wall-flower appear very pretty when fringed by purple ageratum, blue anchusa and mauve lupins, as yellow colour contrasts with blue colour producing a pleasing effect. As a rule primary colours, blues, yellows and reds require contrasts rather than colours of similar shades. However brilliant scarlet shades of salvia and deep orange shades of calendulas, and californian poppies do not harmonize with delicate pink of phlox and daisy, which suffer a good deal when placed in the neighbourhood of such deep coloured flowers. Deep orange calendulas, Eschscholtzias and nasturtiums appear attractive when suitably spaced in pure formations in separate beds. On the other hand yellow colour adds charm and lightness to a mixed border, and patches of yellow Gamolepis surrounded by arcs of purple and mauve verbenas appear very attractive. Flowers of delicate shades should as a rule be placed at the ends of the border, and of stronger colours in the middle. *Thirdly plants grown in a mixed border should flower more or less at the same time.* Early flowering varieties, which also finish early like linaria, and late flowering varieties like cynoglossum which produce flowers in April should not be sown in a mixed border. Dried or seeded stems of linaria do not enhance the beauty

of a mixed border, and pale-blue flowers of Cynoglossum do not appear attractive when surrounded by the dry remains of plants which have flowered produced seed and withered.

CLASSIFICATION OF WINTER ANNUALS ACCORDING TO COLOUR OF FLOWERS

I. White.

Antirrhinum
Asters
Bellis perennis (Daisy)
Candytuft
Freesia
Gypsophila
Lupins
Pansies
Phlox
Stock, White
Sweet Peas

II. Blue and Purple Mauve.

Agathea
Ageratum
Antirrhinum
Aubretia graeca
Cornflower
Cynoglossum
Delphinium
Didiscus
Erigeron
Forget-Me-Not
Heliotrope
Larkspur
Lathyrus
Lavender Shower
Lobelia
Lupins
Nemesia
Nemophila
Nigella
Pansy
Petunia
Phlox
Salvia
Scabious
Statice
Stocks
Stokesia
Sweet Peas
Torenia
Verbena
Viola
Zinnia

III. Pink and light red.

Acroclinium
Antigonon
Antirrhinum
Asters
Bellis perennis
Candytuft
Centaurea
Clarkia
Cosmos
Godetia
Heuchera sanguinea
Larkspur
Lupins
Petunia
Phlox
Poppies
Primula malacoides
Scabious
Statice
Stocks
Sweet Peas
Verbena
Zinnia

IV. Crimson and Scarlet.

Alonsoa
Anemone
Antirrhinum
Asters
Candytuft
Celosia

Cockscomb
Cosmos
Dianthus
Geum
Godetia
Heuchera sanguinea
Larkspur
Linum
Nasturtium
Phlox
Salvia
Scabious
Stocks
Sweet Peas
Tithonia
Verbena
Zinnia

V. Orange Yellow.

Antirrhinum
Calendula
Calliopsis
Cheiranthus
Dimorphotheca
Leptosyne
Eschscholtzia
Marigold
Nasturtium
Pansy
Statice
Sunflower
Viola
Zinnia

LIST OF FLOWERS SUITABLE FOR ROCK GARDENS

Agathea
Ageratum
Alyssum
Asparagus sprengerii
Aubretia
Bellis perennis
Cheiranthus allioni
Dianthus
Dimorphotheca
Erigeron
Eschscholtzia
Linaria, Fairy Bouquet
Lobelia
Marigold, Dwarf French
Mesembryanthemum criniflorum
Mignonette
Nasturtium
Nemesia
Pansies
Petunia, Dwarf
Phlox
Portulaca
Pyrethrum
Torenia
Ursinia
Violas
Virginian Stock
Viscaria
Zinnia, Lilliput

CHAPTER 23

Flower Shows and Flower Arrangements

AN annual flower show adds colour and charm to the life of a town, and is an event which is long remembered for the aesthetic feast it provides to the lovers of flowers. Flower-shows make people flower-conscious and provide an incentive for improving compounds of houses. Unfortunately, our flower-shows attract upper middle classes only, and people who live in crowded streets seldom derive any benefit from them. This is partly due to lack of proper publicity, and lack of contact between the common people and the organizers of such shows. Such flower-shows should be widely advertised by means of slides in cinemas and announcement through loud-speakers and radio broadcasts, so that they become more democratic and cease to be a monopoly of the upper classes only. Prizes should also be given for the best laid-out gardens in the compounds of houses, so that people may take more interest in their surroundings. Instead of giving cash prizes and certificates, flower vases, books on gardening and art, and prints of the pictures of well-known Indian and foreign artists should be awarded as prizes so that people may use them in decorating their houses in an artistic manner instead of cluttering them with piles of unsightly cups, medals and certificates.

Place of Aesthetics in the Education of Women

Our concept of the education of women is based on the fallacy that woman is undeveloped man. Leaders of Feminism in their excessive zeal for advocating the rights of women against their erstwhile persecutors, the males, demanded same education, same powers, and same jobs for women. In this zeal for uplifting the persecuted sex the facts of human physiology were entirely ignored. The body of a woman is fundamentally different from that of man. Her main biological function is reproduction, *i.e.*, the maintenance of the species. The secretions of her ovaries produce those gentle curves and feminine characteristics which we associate with a properly developed female. This does not imply that woman is inferior to man. She is just different. In fact, in many ways she is superior to man, and her contribution to the progress of civilisation is very great indeed.

One of the legacies of Feminism in the syllabus of our girls' schools is the teaching of Algebra, Geometry, Sanskrit and Persian as if the object of women's education is turning out of land surveyors, overseers and classical scholars. We should teach our girls the arts of painting, music, dancing, cooking and general science. We should teach them the principles of Aesthetics, the art of furnishing and decorating the house, and the art of flower arrangement and gardening.

The art of flower arrangement, Ike-bana, has been cultivated for centuries in Japan, and is an essential part of the curriculum of their girls' schools. Young girls and wives should be given lessons in arranging flowers in vases and fairly large number of prizes in flower-shows should be reserved for cut-flowers in vases. The artistic features of the prize-winning flower arrangement should be explained to the audience so that they may learn that beauty lies in simplicity, balance, and artistic blending of colours, rather than in tying flowers in tight bunches smothered with leaves, which our Malis euphemistically call " Guldastas. "

Ike bana

Ike-bana, the art of flower arrangement, is highly developed in Japan, and has a long tradition behind it. It was introduced in Japan from China by Senno-Rikiu, a Buddhist priest, in the sixteenth century. Senno-Rikiu was not merely a priest, but an aesthete and scholar as well. He evolved the ceremony of Tea-Drinking', which is intimately associated with Japanese gardening. He also originated a number of new designs in garden planning, which have left a mark on the landscape of Japan.

All great arts are the results of the efforts of numerous pioneers, some of whom become famous, while others remain obscure. Parallelism in the working of the human brain has not been properly appreciated, and there is a tendency to give disproportionate credit to particular individuals for work which is really the result of the cumulative efforts of numerous minds. So it is in science as also in arts, and Ike-bana is no exception. Artists like Soami,

Magnolia furnishes an excellent material for flower arrangements.

Ritsuami, Monami, Ikenobo and many others set different fashions in flower-arrangement. Ike-bana received further impetus from flower-shows which were held in the court of the Japanese Emperor at Kyoto from the seventeenth century onwards. Religious significance was given to different modes of flower-arrangement and aided by rich symbolism, the art seeped down to the masses in the garb of religious ritualism.

In every Japanese home there is a capacious alcove called '*Tokonama*' in which a flower-vase artistically arranged by the lady of the house is placed. Women-folk give special attention to the alcove in the guest room. All other decoration is excluded, so that the sprays of flowers in the Tokonama become the focus of attention.

The underlying principle of Ike-bana is that of representation of nature on a small scale. As compared with the art of flower arrangement in the west, Ike-bana is less dependent on brilliancy of colour of flowers, and arrangement of flowers, branches and leaves is made with greater attention to the disposition of line. It is the line and the balance of proportion which is the key-note of the composition rather than colour. The whole arrangement is based on the rule of trianguiation. Three branches of cherry blossoms, or a pine branch with two cherry twigs are taken. The longest branch is placed in the middle with the end curved over on one side. Then on one side is put a branch half its size, and on the other side is placed a third spray about half the size of the second twig. The central spray which is the highest represents 'Heaven', the medium-sized twig to the right represents 'Man' and the smallest spray to the left represents Earth. The aim of the entire arrangement is to achieve a free and natural composition. Notches are made in pine branches and wedges of bamboo, and blocks of wood, and fine invisible wires are used to keep the branches in place.

The material used in arranging-flowers consists of twigs of pine, Pampas grass, chrysanthemums, flowering branches of cherry and plum, irises and drooping grasses, and such prosaic objects as clover.

From among aquatic plants, narcissi and irises are favourites in flower arrangement. Small weighted clamps are used for fastening the stalks of irises, so that they stand erect in the bowl. These shoe-like clamps are covered with white pebbles. Clear water is poured over the pebbles and gold-fishes are also introduced in the water of the pale-green dish holding the irises, and how pretty the whole arrangement appears!

Flower Pots and Vases

In India, we are still in the 'Age of the Gamla', the wide-mouthed vase of terra-cotta which has continued unchanged from the times of John Company. No efforts have been made to vary the style and to change the harsh colour of these flower pots. Recently the Cement Marketing Company of India has placed in the market vases, and urns, in Greek, Roman, and Celtic designs

in cement concrete, which certainly look more attractive than the 'Gamlas' and tar-tubs. These are, however, expensive luxuries not within the reach of a person of moderate means. There is need of new designs in earthen flower-pots, which can be painted on the outside in attractive designs.

The Japanese and the Chinese grow Morning Glory in blue and white pots which they place in the verandahs of their houses. They grow chrysanthemum in green, blue and white pots. We, too, should introduce some variety in the shape and colour of our flower-pots. For painting flower-pots and stands Etruscan pink and Celaden colours are suitable. Celaden resembles the jade and is made by mixing Prussian blue and a little chrome yellow in white paint.

Vases

Variety in the shape, size and colour of flower vases is a necessity in the art of flower-arrangement. The Wedgwoods and the Royal Copenhagen Porcelain Company in England have produced some elegant designs in porcelain. In Japan wide-mouthed vases of bronze or porcelain, wicker baskets of various shapes, stained to resemble bronze, and bucket-shaped bamboo-vases are used. In India, the present author induced some of the carpenters of Hoshiarpore, who specialize in lacquer work, to make plain vases of seasoned Sheesham wood and their creations were sombre and dignified pieces of art. Copper or brass vessels can be concealed in wooden bowls and vases, and flowers can be placed in them.

The Gwalior Potteries with their exquisite flower vases have come to the aid of flower lovers in our country and offer a wide selection of vases of different patterns, sizes, and colours. There are big urn-like vases which can be used for placing blossom-covered branches of Kachnar, double peach blossoms, spikes of Lagerstroemia, and even scarlet flowers of Gul Mohur and Dhak. Branches of pink blossoms of Kachnar appear exceedingly charming in black urn-like Gwalior vases. Scarlet flowers of the Dhak bursting out in full glory from their dark brown calyces appear very attractive in a cream-coloured vase. Golden yellow flower-laden branches of Peltophorum appear very pretty in light blue vases, their light blue colour providing a heavenly contrast with the golden yellow colour of the flowers. The pink and mauve racemes of *Lagerstroemia thorelli* and *L. flos-reginae* appear charming in a light green vase. Cassias are unsuitable for cut flowers, for their flowers wilt in a few hours even when placed in water. Thus we are deprived of the pleasure of using the pink blossoms of *Cassia nodosa*, and yellow racemes of Amaltas in interior decoration. For ladies who possess aesthetic taste and deft fingers, ornamental flowering trees provide an excellent material for flowering arrangement. This is especially welcome in the season when annual flowers are no more, and scorching winds kill most of the annual plants.

Arranging Flowers

One of the necessary preliminaries in the arrangement of cut-flowers in vases is the plucking of leaves. Pluck all leaves from spikes of antirhinum,

larkspur, salvias etc. and then arrange them neatly in vases avoiding the temptation of putting in too many. Flowers of orange and scarlet shades look very striking in black vases and placed in a comparatively dark corner of the room have a cheerful effect. Orange calendulas, nasturtiums, cosmeas, Californian poppies, and even common marigolds (Gainda) appear attractive in a flat black vase. Scarlet salvia looks very attractive in a black vase. Pink and red flowers like roses, dahlias, pink antirrhinum look exceedingly pretty in long flask-like narrow-necked green vases. Magenta-coloured Bougainvillaea flowers look charming when mixed with deep magenta globe Amaranth in a green vase. Purple, blue, and scarlet verbenas show to their best advantage in cream-coloured vases. Blue, purple fluffy heads of ageratum placed in a brass utensil concealed in a broad wooden bowl are very soothing. A mixture of blue, scarlet and purple verbenas, white candytuft, pink and red phlox, multicoloured linaria appear very pretty in a Kashmiri willow basket. Long-stalked flowers of gerbera, cosmea, cosmos, and arctotis appear pretty in narrow polished brass vases. Sweet peas can be arranged in various ways. However they appear at their best in small cylindrical copper vases. I saw a very pretty display of sweet peas in a house in Lucknow with these pretty flowers scattered irregularly in a casket-shaped copper vase, open at the top. Chrysanthemums with very short stalks, especially the mauve shades, too, look attractive in such a vase.

If one has colour sense, and appreciation of the principles of colour harmony and colour contrast, one can evolve numerous new types of arrangements. Endless permutations and combinations are possible, and the hints given above are merely suggestive.

Framing Flower Vases

Mrs. Templeworth advises the use of coloured pieces of silk or satin for placing on white table-cloths under flower vases. She recommends the following colours—pale blue, pale pink, apricot, eau-de-nil, and light poppy red. Pieces of satin in the above colours about 2½ feet square placed under vases, serve the same function as frames for pictures. A piece of silk about three yards long may be used for big tables. Thrown into carefully arranged billows, its folds can be used for covering saucers and shallow vases filled with flowers. The variety in the colours of vases available now has rendered the use of such pieces of coloured silk redundant, but the experiment is worth trying in some cases.

Material for Flower Arrangement

Not only flowers of trees, shrubs, climbers and annuals but even leaves of common trees and grasses, and berries of shrubs furnish valuable material for flower-arrangement. Newly produced coppery leaves of mangoes, jamuns, Asoka, Browneas, and *Diospyros embryopteris* furnish beautiful material for mixing with flowers. The drooping broad leaves of *Ixora praviflora* look very

pretty with heads of Asoka blossoms. Leaves of grasses like *Arundo-donax versicolor* go well with petunias. Finely divided leaves of *Millingtonia*, *Moringa*, *Tecoma stans*, *Grevillea*, *Cypress* and *Maiden-hair fern* are used for mali's 'Guldastas'. Berries of Duranta and Karonda with leaves removed are also used in decoration.

Holding Flowers in Situ

One of the difficulties which one faces in flower-arrangement is that of keeping flowers in situ. Flowers falling off the edge of a vase are a source of irritation and waste of time. Coarse wet sand may be used in some cases. Glass or porcelain domes with holes pierced in them are suitable for shallow vases. One may also use coils of thick wire or clamps.

One of the problems which a person interested in flower arrangements has to face is, that of keeping flowers fresh. For this it is desirable to know a few facts of plant physiology and anatomy.

Keeping Cut Flowers Fresh

A constant stream of water with mineral salts in solution is ascending through xylem, the tube-like conducting tissue of plants from roots to leaves and flowers. This stream of water is known as "Transpiration Current". When water reaches leaves and flowers it evaporates. All factors which check the suction of water in the xylem tubes and promote the evaporation of water from the top, are the cause of rapid wilting of flowers when cut and placed in vases. All methods which are adopted for preserving cut flowers for longer periods are based on the above facts, and attempt is made to reduce evaporation from the top, and to promote the flow of water from below. High temperature and dry wind increases the rate of evaporation and consequently the speed of transpiration stream. In the dry month of June when hot winds blow, tips of petals of flowers dry up, as water evaporates more quickly from the surface of the petals as compared with that sucked up from the vase. Flowers cut in the morning last longer as compared with those cut in the noon or evening time. Microscopic air-bubbles act as formidable obstacles in the path of the transpiration current, and if these are excluded by cutting the stems of flowers under water, the transpiration stream will remain comparatively uninterrupted.

The following methods are useful in keeping flowers fresh for comparatively long periods :—

1. In the case of woody stems as in the case of flowers of trees, and shrubs including roses and chrysanthemums, splitting of the lower part of the stalk for 2-3 inches promotes the rise of water. Peeling of the stalk for an inch or so from the base has a similar effect.

2. Removal of leaves reduces the rate of transpiration. Thus flowers keep fresh for a longer period and also appear more beautiful.

3. In the case of plants containing latex, the stem should be sealed by immersing in boiling water for a minute or so. This is useful in the case of poppies which otherwise shed their petals soon.

4. Renew the water in the vases every day. Water can also be kept comparatively clear if lumps of charcoal which absorb impurities are placed in the vase.

5. A tea-spoonful of sugar added to the water of the vase, is said to be effective in the case of Compositae, like asters, daisies, arctotis, etc.

6. Aspirin is reported to have stimulating effect on the cells and is said to be useful for cut flowers.

7. A sharp pair of scissors should be used for cutting flowers so that conducting tissues are not mangled, and flowers should not be plucked anyhow.

List of Ornamental Flowering Trees, Shrubs, Climbers and Annuals suitable for Cut-flowers in Flower-arrangement.

1. Ornamental Flowering Trees.

No.	Name.		Hints on Flower-arrangement.
1.	Bauhinia variegata—		
	(*a*) White variety	....	Arrange the blossom-covered branches in a black vase.
	(*b*) Pink variety	....	Appears charming in a wide-mouthed black vase.
	(*c*) Purple-mauve	...	Arrange the branches in a cream-coloured vase.
2.	Bauhinia krugii	...	Arrange the flowers in a soup plate filled with wet sand fringed with Cyanotis, and place on an apricot-coloured piece of satin.
3.	Bombax malabaricum	....	,, ,,
4.	Butea frondosa	....	,, ,,
5.	Colvillea racemosa	....	,, ,,
6.	Cordia sebestina	....	,, ,,
7.	Jacaranda mimosaefolia	....	Light yellow vase is indicated.
8.	Lagerstroemia thorelli	....	Arrange the branches in a pale-green vase.
9.	Lagerstroemia flos-reginae	....	,, ,,
10.	Melia azedarach	....	Use a pale-yellow or cream coloured vase.
11.	Milletia ovalifolia	...	,, ,,
12.	Peltophorum ferrugineum	....	Arrange the flowers in a light blue vase.
13.	Saraca indica	....	A cream coloured vase will suit.

II. Shrubs and Perennials

No.	Name.	Hints on Flower-arrangement.
1.	Cannas	Short-lived as cut-flowers. Place in a tall light green vase.
2.	Chrysanthemums ...	Cut the heads of flowers and place in a casket-shaped copper vase.
3.	Ixora bandhuca ...	Remove all leaves from its red corymbs and arrange them in a cream coloured vase.
4.	Lagerstroemia indica (pink) (white) (purple) (mauve)	Mix with sprays of *Arundo donax* and arrange in a pale green vase and place the arrangement on a pale blue piece of silk. The pink variety mixed with new leaves of Jaman or Acalypha looks splendid in a long handled willow basket.
5.	Oleanders (pink and white)	White oleander mixed with Dodonea leaves looks attractive.
6.	Plumbago ...	Place in a white porcelain vase Also looks attractive in a wicker-basket painted red.
7.	Poinciana pulcherrima	Appears pretty in a black vase.
8.	Tecoma stans ...	Remove all leaves, mix its yellow bells with pink oleanders and place on an apricot-coloured piece of silk.
9.	Tabernaemontana coronaria	Its white flowers look pretty at night time.
10.	Roses	Show at their best in light green vases.
11.	Zinnia linearis ...	Appears very pretty in a pale-blue vase.

III. Climbers.

1.	Antigonon leptopus	Remove all leaves. Its pink flowers look attractive in a narrow-necked cream-coloured vase. Place the arrangement on a pale-blue piece of silk.

No.	Name.		Hints of Flower-arrangement.
2.	Bougainvillaea—(magenta) (orange)	...	Remove all leaves from the branches bearing flowers and mix a few heads of Globe Amaranth and arrange in a pale-green vase.
3.	Bignonia venusta (orange)	...	Cream-coloured vase is indicated.
4.	Petrea volubilis	...	Its flowers appear very pretty in a cream-coloured vase.
5.	Porana paniculata (Bridle-creeper)	...	Its white flowers look very pretty in black I shallow vases.
6.	Quisqualis indica (Rangoon creeper)	....	Appear pretty in a garniture of Teak blossoms.
7.	Sweet Peas	....	Look pretty in copper vases.

IV. Annuals

(*I*) *Winter Annuals*

1.	Ageratum	....	Displays well in a broad wooden bowl of Sheeshum.
2.	Anemone	....	A pale-blue vase is indicated.
3.	Acrocliniurn	....	A light-green vase is suitable.
4.	Aquilegia	....	A cream-coloured vase is suitable.
5.	Aster	....	Look pretty in a pale-green vase.
6.	Calendula	...	Its orange colour shows remarkably well in a shallow black vase.
7.	Calliopsis	...	Appears suitable in a pale-green vase.
8.	Candytuft	....	Appears attractive in a black vase.
9.	Capsicum (celestial)	....	A black or buff-coloured vase is suitable.
10.	Centaurea	....	Cream-coloured vase is suitable.
11.	Chrysanthemum (Annual)	....	Place in a pale-green vase.
12.	Clarkia	....	Its pink flowers mixed with pink antirrhinum, pink, phlox, and pink gypsophila, placed in a pale-green vase appear charming.
13.	Coprosma variegata	....	Placed in small narrow necked vase of glass, it appears beautiful.
I4.	Coreopsis	...	Place in pale-blue vase, contrasting with the yellow colour of these flowers.

No.	Name.		Hints on Flower-arrangement.
15.	Cosmea	....	Place in pale-blue vase, contrasting with the yellow colour of these flowers.
16.	Cosmos	....	" "
17.	Dahlia	....	Place in a long necked pale-green vase.
18.	Delphinium	....	Its blue shades appear attractive in cream or pale-yellow vases.
19.	Eschscholtzia	....	Its orange coloured flowers appear exceedingly pretty in a shallow black vase.
20.	Gaillardia	....	A pale-green vase is indicated.
21.	Gerbera	....	Place in a, long cylindrical copper vase.
22.	Godetia	....	Appears attractive in black and cream-coloured vases.
23.	Gypsophila	....	Mix with pink antirrhinum and place in a plain wide-mouthed copper vase.
24.	Helichrysum	....	Place in a maroon-coloured vase.
25.	Heuchera	....	Place in a pale-green vase.
26.	Hollyhock	...	Very effective in tall vases mixed with gypsophila or Teak blossoms.
27.	Larkspur	...	Pale-yellow, cream-coloured or pale-green tall vases are suitable
28.	Leptosyne	....	Place in a pale-blue or black vase.
29.	Linaria	....	Maroon, pale-pink or pale-green vases match its flowers.
30.	Lupin	....	Cream-coloured vase is indicated.
31.	Nasturtium	....	Remove the leaves and place its orange flowers in a black shallow vase.
32.	Nemesia	....	Place in a small pale-blue vase.
33.	Nemophila	....	Place in a small narrow-necked, yellow vase.
34.	Nigella	....	Appears at its best in a broad wooden bowl.
35.	Pansies	....	Remove the stalks of flowers and place in a small ring-shaped cream-coloured vase

No.	Name.		Hints on Flower-arrangement.
36.	Petunia	....	Cut long sprays and arrange them with leaves of *Arundo donax* in a pale-yellow porcelain vase.
37.	Phlox	....	Light pink or maroon-coloured vase is suitable. Remove all leaves and place one variety each, white, pink or red in a saucer filled with wet sand, and conceal these saucers in waves of light-green or pale-blue silk.
38.	Ranunculus	....	Cream-coloured vase is suitable.
39.	Rhodanthe	....	Pale-green or pale-blue vase is suitable.
40.	Salvia	....	Appears very pretty in a flat black vase.
41.	Scabiosa	....	Place in a pale-green vase.
42.	Shasta Daisy	....	Place in a long copper vase.
43.	Statics	....	A black vase is suitable.
44.	Stocks	....	Place in a small pale-green vase.
45.	Sweet Peas	....	Copper vases of various shapes are suitable. Pink Sweet Peas look very attractive at night time in electric light.
46.	Sweet Sultan	....	Place in a long copper vase.
47.	Verbena	...	Place heads of Verbenas in a cream-coloured circular ring-like vase.
48.	Wall flower	....	A small light blue vase is suitable.

(2) *Rainy Weather Annuals.*

1.	Balsam	....	Can keep fresh for a day in wet sand. Otherwise unsuitable.
2.	Celosia	....	Place the flowers in a light green vase.
3.	Cosmea	....	Appears very attractive in long-necked pale-blue, and light-green vases.
4.	Globe Amaranth	....	Mixed with magenta flowers of Bougainvillaea it appears very pretty in a light green vase.
5.	Marigold	....	Appears very pretty in a black or pale-blue urn-like vase.

No.	Name.	Hints on Flower-arrangement.
6.	Zinnia	.... Remove the leaves and place the flowers in a tall light green vase. Select only crimson, orange, yellow, and pale yellow flowers, and discard pink or magenta shades. Zinnias keep fresh for a long time.

V. Bulbs.

1.	Amaryllis	.... Place in a pale-blue or black vase. Use copper coloured new leaves of mangoes as garniture.
2.	Calla	.... All these flowers appear attractive in long narrow-necked pale-green vases or long cylindrical copper vases. During and after rains lilies and cannas keep fresh for fairly long and in the hot months of May and June they wilt in a short time. Tuberoses are particularly desirable during monsoons and are cherished for their delicious fragrance.
3.	Cannas	
4.	Daffodils	
5.	Freesia	
6.	Gladiolus	
7.	Gloxinia	
8.	Hyacinth	
9.	Iris	
10.	Tuberose	

CHAPTER 24

Introducing New Plants

SINCE the time the primitive man began to gather seeds from plants growing wild in the fields, and by slow and crude methods to improve them, he has been enriching his diet by adding new varieties of food crops and fruit trees. After he conquered the barriers of land by domesticating the ox and the horse, and of water by inventing the canoe, an extensive exchange of plants has been going on between the continents of Eurasia and Africa. However, the Americas remained isolated for a long time from the Old World. If we examine our crops and trees, we will find that a large number of them have been introduced from foreign countries. Potatoes which furnish food to millions came to this country from South America *via* Europe only in the 17th century. Quinine was unknown in the East and Cinchona plants were introduced from South America to Java and other Eastern countries not very long ago. Soya bean has been introduced from Manchuria into America and Europe and Para Rubber from South America into Java, Malaya and India

The Black Mulberry came from Persia. Peanut was introduced by the Portuguese in India and Africa from Peru. Papaya (*Carica papaya*), whose fruit is a valuable source of papain, a digestive enzyme resembling animal pepsin, which is particularly useful for meat eaters, is a native of Central America and the West Indies. A few high-yielding varieties like Washington, Giant Hawaii Ceylon Long, Ranchi Mammoth and Calcutta have been selected as suitable for

India and there is no doubt that there are others in their home countries which may repay introduction. Who can imagine Kashmir without its chenars, poplars and willows? Yet these chenars and willows are exotics, which were introduced by the Moghuls from Central Asia, while the Lombardy poplar is a recent introduction. We may also mention that until recently the strawberry was practically unknown in the plains of Northern India. It was introduced in Kapurthala from France by Mr. D. R. Sethi in 1918 and now it is commonly grown in the villages of Jullundur district.

Most of our ornamental flowering trees and garden plants have been introduced by garden-loving British travellers, explorers and government officers from foreign countries like South America, Madagascar, Malaya, Java, West Indies and Burma. *Poinciana regia*, and *Colvillea racemosa* were brought from Madagascar, *Jacaranda mimosaefolia* and ramie tree from Brazil, *Brownea ariza* and *Bauhinia purpurea* from West Indies, *Cassia Javanica*, and *Peltophorum ferrugineum* from Malaya, *Spathodea campanulata* from Tropical Africa, and double flowering peach from Japan. The dogwood tree (*Cornus florida*) with beautiful white flowers deserves to be introduced in our hilly areas from the United States of America. The Pink Bombax (*Bombax ellipticum*) of Hawaii is another desirable ornamental tree.

The popular blood red orange was introduced by a deputy commissioner of Gujaranwala from Malta. The seedless Washington Navel orange originated as a bud sport of a Portuguese variety of orange in Brazil and was introduced in California in 1878. This variety is also a recent introduction in India and is becoming popular. The summer orange, Valencia, which ripens from February to April, is an introduction from the Azores, a group of Portuguese islands in the Atlantic.

One of the recent introductions is that of the Teasel plant (*Dipsacus fullonum*) by Mr. Jai Chand Luthra who got a few seeds of this plant from the Botanical Garden at Duisberg in Germany in 1931 and successfully cultivated it at Kulu and Palampur in Kangra District. The heads of this plant are used for raising floss on the surface of woollen goods, and a few years' cultivation of Teasel has made India independent of foreign imports.

Plant Introduction Service in the U.S.A.

In the United States of America, the plant Introduction Service was organized by the State Department of Agriculture as long ago as 1903. Dr. David Fairchild, who has done great service to his country by organizing the Plant Introduction Service, also introduced some of our best Indian mangoes in Florida. The United States Plant Exploration and Introduction Service sent capable botanists like Walter T. Swingle and William E. Whitehouse to unexplored regions of North Africa and Asia and these explorers have amply

served their country by introducing a large number of economic plants. It is perhaps not commonly realized that excepting the persimmon, avocado, grapes, berries and a few plums, America had no important fruit trees and the only known food plants were maize, potatoes, sweet potatoes and tomato. Most of the green vegetables grown in America have been introduced from outside.

In the State of South Dakota. Carleton and N. E. Hansen introduced a white-seed variety of Prosoa a panicled millet from Semipalatinsk in Siberia. It is a catch crop maturing in 60 days suitable for a dry 8 in. rainfall climate and may repay introduction in dry areas like those of Rajputana.

Two most valuable introductions in the U.S.A. are the Smyrna fig and the date-palm. Along with the Smyrna fig, *Blastophaga*, a tiny pollinating wasp which carries pollen from the male tree (the Capri fig) was also introduced. Excepting banana, the date-palm produces more well-mineralized high-flavoured and healthy human food per acre than any other crop.

Swingle introduced in the U.S.A. a number of varieties of date-palm from Morocco, Tripoli, Egypt, Arabia, Iraq, Iran and the Southern States of America. He brought the remarkable Medjhool from the Taflilat region of Southern Morocco and Deglet Noor variety from Southern Tunisia. On account of these introductions more than 1,000 choice varieties have been tested in the date gardens of Southern California and Arizona, and the total annual production of dates in the United States of America exceeds 13,000,000 lb., which is one-quarter of the total consumption. In spite of its marked xerophytic character, the date-palm requires plenty of irrigation. The Arabs rightly say that the date-palm must have its feet in running water and its head in the fires of heaven. These conditions are met in an ideal state in the canal-irrigated areas of the Punjab and Rajputana. In spite of such favourable circumstances, we have introduced only a few varieties of date-palm in India. In 1910, Hallawi and Khadrawi varieties were introduced from Basra in the gardens of the Lyallpur Agriculture College and from there have been propagated in the Multan district. Choice varieties of dates should be introduced on a large scale in the canal-irrigated areas and grown along the banks of canals and water courses. The date-palm is a tall tree and does not cast much shade and as such is not harmfnl to the corps.

New economic plants

With the coming of quicker means of transporation, particularly the steamship and the railway, the world exchange of plants has been going on at a quicker pace, and on a much vaster scale. However, the possibilities of plant introduction, particularly from the point of view of plant breeding, are still far from exhausted. Cassava (*Manihot utilissima*) has been tried in South India. Starch palm (*Bactris utilis*) which is so popular in South America, may prove to be of considerable value in tropical parts of India. Tung-oil tree (*Aleurites*

fordii) is being tried by the Forest Research Institute and Olive (*Olea europea*) deserves to be introduced in dry hilly areas of the North-West Frontier Province. With the diversity in climate which India possesses, of there is no doubt that our stock of economic and ornamental plants can be greatly increased.

Plant exploration

In India, we are fortunate in having such a variety of soils and climate that plants from all regions of the world from the arctic to the tropical can find a congenial home. Dr. A. C. Joshi has drawn our attention to the vast potentialities of our country from the point of view of plant introduction on account of its favourable geographical situation. Out of the six 'primary centres' of origin of cultivated plants recognized by Vavilov and other Soviet scientists, three, viz. Central Asia, the mountains of Eastern China and the Indo-Malayan region, border on India. These are the homes of most of the Old World fruit trees. Dr. B. P. Pal thus summarizes information about the various centres of origin of cultivated plants and possible causes of production of new varieties:

'In their respective centres of origin, cultivated plants display a wealth of varietal diversity which is not to be found elsewhere. A characteristic feature is that these primary centres frequently include a large number of genetically dominant characters.

'The researches of Vavilov and his co-workers have shown that the region of north-western India and south-eastern Afghanistan is the place of origin of the soft and club wheats and also of many other field and garden crops, *e.g.* rye, pea, lentil, beans, flax, carrot, etc. The 28-chromosome group of wheats has had an entirely separate centre of origin in Abyssinia. The Eastern Asiatic region has probably seen the origin of rice, soyabean, and some of the millets. In the New World the rather restricted territory of Central America (including Southern Mexico) is the home of such plants as maize, teosinte, the common bean, annual pepper, agave, anona, sapota, papaya, etc. Tobacco probably originated in South America. The potato plant probably had more than one centre of origin. While the island of Chiloe and the neighbouring islands of the coast of Chile are probably the centre in which the common cultivated potato originated, many cultivated and wild species have originated in the Peru-Bolivian tableland.

It will be apparent that many of the important centres of origin are associated with tropics or sub-tropics and the presence of mountains. This may, perhaps, be connected with the fact that in such regions an optimum of moisture, heat, light and substratum have afforded favourable conditions for the origin and accumulation of varietal diversity. Mountainous areas tend to act as isolators and thus may have played a part in the differentiation and divergence of species and varieties. An interesting speculation that cosmic rays might be responsible for the greater diversity and density of species near the mountain tops has been advanced by Dixon, Hurst and, more recently, by Hamshaw Thomas.

The cosmic rays are particles of very great energy which are constantly reaching the earth in very great numbers and closely resemble the x-rays in their properties and effects. As x-rays are at present the most efficient agents known for the artificial production of mutations, it appears possible that cosmic radiations may have been a factor in the production of varieties by direct action on the germ plasm. It is interesting to note that the centres of origin of cultivated plants are often near the centres of ancient civilization.

We hope to achieve considerable improvement of our fruit trees if we explore these regions systematically. Apart from exploring the Himalayas and mountainous regions of South India, we should send expeditions to China, Java, Malaya, Afghanistan, Iran, Iraq, Africa, Central and South America to search and bring new fruit and ornamental trees and shrubs as well as the wild ancestors of crop plants. For orchard fruit and nut trees like apricots, peaches plums, almonds, pistachio and walnut, Afghanistan, Iran, Iraq and Western Turkey should be explored. The Hindukush is regarded as the home of a number of important cultivated crops and will repay exploration from the point of view of disease and frost resistance.

China as a source of new plants

China can also furnish us with a great variety of vegetables, such as radishes, beans, etc. Dr. B. P. Pal and Chander Bhan brought seeds of a number of Chinese vegetables to India. On account of the periodical ravages of floods and famines, the Chinese have investigated the food value of a number of edible weeds. *Momordica grosvenori* Swingle, the rare seasoning weed, *Lohan kuo* is grown in the mountains of Kwangsi province and is prized as a condiment as well as a remedy for throat and intestinal disturbances. Rhubarb is also of Chinese origin. *Ephedra sinica*, a valuable source of Ephedrin and a well-known alkaloid used for throat and nose troubles, was introduced in California from China by Swingle in 1926. Swingle spent a number of years in China exploring the interior of the country and he reports that there are 1,000 distinct varieties of citrus cultivated in all of the provinces south of the Yangtze river. Some of these are hardy and disease-resistant and some are valued for their flavour. Some varieties grown in California have their home in China. However, it may be mentioned that even with their efficient Plant Exploration and Introduction Service, the Americans have not tested more than 10 percent of the Chinese varieties. South China, the home of the orange, deserves close exploration and it is necessary that we too should introduce some of the best Chinese varieties in India.

New plant material for the geneticist

In most countries, excepting the U.S.A. and the Soviet Union, the work of introduction of new plant material and its use in hybridization with local varieties has been carried on a limited scale. In the Soviet Union, Vavilov and his co-workers have collected plant breeding material from many countries. Nume-

rous wild species of wheat and barley have been collected from Abyssinia, Turkey, and Afghanistan and many species of peas, beans, tomatoes, onions, melons, pears, peaches, apples and grapes from countries all over the world. As a result, cold-resisting and early maturing varieties of wheat have been propagated in Siberia which served as the Soviet bread-basket when Ukraine was occupied by the Nazi armies in the Second World War.

Considering the variety of plant material at the disposal of the Soviet plant-breeders, endless possibilities of origin of new plants arise. How this has affected the outlook regarding the future plantbreeding work can be well-judged from the following remarks of Vavilov himself : 'Our ideas of such plants as the potato have been entirely revised, the whole work of breeding and genetics had been formerly based on one Linnean species, *Solanum tuberosum*, whereas the expedition to South America disclosed the existence amongst the cultivated potatoes at its original home of no less than thirteen well-defined Linnean species, many of which are of great practical interest. These species differ from one another in chromosome number, morphological and physiological characters and area of distribution. They contain species and forms extremely resistant to diseases and frost. The potatoes formerly known to geneticists and breeders were only fragments of one species, collected at random by the first travellers, and on these the whole of the breeding and genetic work of the nineteenth and the beginning of the twentieth century has been based.'

Besides the cultivated plants we must take into account the wild plants. There was a time when wild plants were considered to be of interest to the taxonomist only. It is now coming admitted that greater possibilities in breeding could be realized by making use of the wild relatives of our cultivated plants. By virtue of their persistence and habitat under arduous conditions of climate and soil, the wild plants possess some useful economic characters such as resistance to cold, drought and diseases, etc. Many instances may be quoted of the successful ultilization of wild forms in the solution of economic problems in plant breeding. The Java sugar industry, which was at one time threatened with collapse on account of serious losses caused by the Sereh disease, was saved by the timely introduction by Kobus of a wild variety of cane from India known as Chunnee. The famous series of canes developed at Coimbatore has been the result of crossing with the wild species *Saccharum spontaneum*. The production of perennial hardy varieties of wheat by Tzitzin in Russia by making use of the wild grass *Agropyron* is another outstanding example. These wheats are considered very promising for new tracts, with highly unfavourable weather conditions. Harland has reported interesting results in cotton. The hybird of the wild Hawaiian species *Gossypium tomentosum* with Sea Island has produced a beautiful khaki lint of Egyptian quality and is completely

immune to attacks of leaf-sucking insects. Potato breeding work has been revolutionized by the discovery of wild tuber-bearing species, viz. *Solanum demissum*, *S. acaule*, *S. commersonii*, etc. some of which are resistant to frost and others to late blight caused by *Pytophthora infestans*.

Bureau of Plant Introduction

Though the contribution made by explorers and travellers of the 19th century is very valuable, the time has come when we must recognize that a work of such importance cannot be left to the whims and fancies and comparatively poor resources of private individuals. A systematic, organized and planned effort is needed and work of plant exploration and introduction should be placed on a sound national footing.

CHAPTER 25

New Plants for Old

PLANT breeders have made a great contribution to human prosperity by developing improved varieties of crops. The plant geneticist has made two ears of corn to grow where one, grew before and in some cases these two ears are also better in quality. It has been generally realized that one of the cheapest yet permanent means of improving plants and animals, is by breeding better types. The advantages of superior varieties of crops are that they are better in productivity, have more uniform and attractive market produce, and they have such agricultural attributes as earliness, higher yield, uniform maturity and greater resistance to disease. By placing improved varieties of sugarcane, cotton and wheat in the hands of the cultivator, the Indian Council of Agricultural Research has materially enhanced the wealth of the country. The improved sugarcanes alone have checked a drain of crores of rupees to foreign countries. The Pusa and Lyallpur wheats have appreciably increased the food supply of the country and improved varieties of cotton have provided higher yields.

How are new plants produced ? Let us probe into the mysteries of plant breeding by examining some common garden annuals.

The gardening history of familiar flowering annuals is very interesting and reveals how explorers, naturalists, gardeners, florists and botanists of England, Germany, Holland, France, and the U. S. A. discovered, acclimatived, and hybridized various varieties of dahlias, asters, sweet

peas, verbenas, and phloxes, which we in India collectively call English flowers. The common phlox is a native of Texas, U. S. A., and was discovered by Drummond, an American botanist after whom it is called *Phlox Drummondi*. sweet pea was introduced in England from Italy in 1699 when Franciscus Cupani, an Italian monk sent some seeds to a Dr. Uvedale of Enfield. The garden stock is found wild even now in the Isle of Wight, and has been grown in the gardens of England and Europe from early times.

The history of asters and dahlias reads like a romance and sheds light on the origin of new varieties. A single flowered aster belonging to the species *Callistephus chinensis*. (Family : Compositae) grows wild in the rocky hills of Northern China. It is an annual with a thin rosette of spreading branches, and the flowers are yellow in the centre and violet blue on the circumfrence, with yellow hermaphrodite disc florets and violet blue female ray florets. Seeds of this wild variety of aster were sent to Germany from China in 1728 A. D. where it yielded violet, red, and white varieties. By the end of the eighteenth century, rose, lilac, blue, and purple colours had also appeared. A true yellow appeared recently. Subsequent variations have mainly concerned the form and size of flowers.

The common dahlia was discovered by the German naturalist Von Humboldt in Mexico in 1789. In that year he sent two plants, one with purple, and the other with rose-coloured flowers to the court of the Spanish King at Madrid. From there it was imported into England in 1804 by the Marchioness of Bute, the wife of the British Ambassador. In the same year Humboldt sent its seeds to Berlin and Paris. From 1804 a phenomenal change took place in the development of the dahlia, and numerous variations in form and colour arose at a rate without parallel in the history of domesticated plants. In 1806 the Berlin Botanical Garden reported 55 single and semi-double varieties. In 1808 practically all colours were obtained including new patterns as dark eyes and red-ringed discs. In 1830 a Swiss amateur reported 1500 varieties. Soon after pompon and cactus varieties appeared. Now we hear about tree dahlias with plants 16 ft. high producing panicles of flowers over two feet across. Thus ends the story of the two original species of dahlias, the crimson *Dahlia coccinea* and the yellow *Dahlia variabilis*, though it has by no means closed, and the number of varieties will go on swelling through mutations and hybridization. In India dahlia was introduced most probably in 1865 A. D.

Cells and chromosomes

As houses are made of bricks, similarly bodies whether of plants or animals, are made of certain units called cells. Each cell contains a denser central part called the nucleus, and granular viscid living matter called cytoplasm, and this, in its turn, is surrounded by a cell-wall which maintains the cell's entity. While the different parts of the cell have particular functions to perform,

the nucleus is the most important from the standpoint of heredity. The nucleus contains a fixed number of rod-like bodies called chromosomes, which are evident only at the time of cell division. The number of chromosomes is fixed for each species. The number of chromosomes in onions is 16, inmaize 20, and in rice 24. The number of chromosomes in man, potato, and common wheat is 48 and if you take a cell from any part of a European, a Chinese or a Negro you will find the same number. The cells of Adolf Hitler contained the same number of chromosomes as those of a Zulu from Africa.

Two types of cell-division take place in plants and animals, one of which is called 'Ordinary Division' and the other 'Reduction Division'. Ordinary division takes place in cells of the body, and that is how growth occurs. In this the chromosomes split longitudinally in equal halves so that each daughter cell contains the same number of chromosomes as the parent cell. Reduction division takes place in reproductive cells and in this operation half the chromosomes go bodily in one gamete-mother-cell and the remaining half in the other. Thus eggs and sperm cells contain half the number of chromosomes of a body cell ; the reproductive cells of man have 24 chromosomes, of rice 12, and of maize 10. When they mate together the normal number of the species is restored. This is a very sensible device, for it prevents the duplication of the number of chromosomes, which will go on increasing in geometrical progression if there were no reduction division. However, this mechanism some times fails and we do get duplication or triplication of chromosomes resulting in giant varieties. This phenomenon is called polyploidy (Figs. 1 and 2).

Genes

All the characters of an individual are represented in its chromosomes in a condensed form, e. g. the colour of eyes, the shape of nose, the colour of skin, the colour of hair in man, and the colour and form of flowers in plants. Chromosomes are the bearers of hereditary characters and represent a macrocosm within a microcosm. The chromosomes are thread-like bodies, and have specific regions which are concerned with the development of particular characters of a species. These regions are infinitely minute and are known as 'Genes'. The genes are the atoms of heredity. There may exist one or few or several genes for a character.

Linkage and Crossing Over

It has been found that certain characters are inherited together in a group, e. g. black body colour and vestigial wings in the fruit fly *Drosophila*. What is the meaning of this phenomenon of linkage ? Morgan, an American biologist, explains that this is due to the presence of both the factors for black body colour and vestigial wings in the same chromosome, that is why they go together. However, these factors *do not always* go together, though they are linked in the same chromosome. We find a definite percentage of fruit flies with black body and normal wings and grey body and vestigial wings. What

is the explanation of this crossing over of characters located in different chromosomes? Morgan explains that at a certain stage the chromosomes come in contact with each other and interchange definite sections from the point of contact. This crossing over takes place with greater frequency in the case of factors which are situated at the ends of chromosomes widely separated from each other, as compared with factors which are situated more close together. From the frequency of this crossing over, Morgan and his co-workers Muller and Bridges, have been able to locate the different factors in *Drosophila*, and have mapped its chromosomes. This work of Morgan will ever remain a classic and is as important as Newton's discovery of gravitation.

What is the cause of variation and what is the mechanism of the changes which occur in the reproductive cells of flowering plants? How do we get double-flowered purple-mauve asters, and double pink dahlias from original single varieties with inelegant colours? What is the cause of the origin of pink, and blue flowers of sweet peas from ugly purple bicolour flowers of the ancestral plant? The cause and mechanism of these variations is the same which resulted in the evolution of man himself from hairy ape-like ancestors, and of horses from four-toed sheep-like ancestors. The cause of variation and the mechanism of its inheritance in the plants and animals is more or less the same, and before we learn how we get new plants from old, it is essential to understand certain primary facts of Biology.

Sex in plants

In plants also we find male and female sexes as in animals. In some primitive plants like the ferns, *Cycas*, and *Ginkgo*, we find living motile sperms which are produced from the pollen and actively swim about in drops of water as in animals. In flowering plants motility is lost and the male element is merely a mass of living matter or only a nucleus. The egg which becomes the embryo is securely enclosed in an ovule, which after fertilization becomes the seed. An ovule or a number of ovules are securely enclosed in a folded leaf-like structure, the ovary, whose upper part, called the stigma, receives pollen-grains through the agency of bees, or butterflies that come to suck honey from nectaries at the base of anthers and the ovary. The pollen-grains are produced in sac-like structures called anthers and germinate on the stigma. They produce long tubes which penetrate the stigma, and carry the male nuclei through the folds of the ovule to the egg-cells which they fertilize. The fertilized egg develops into an embryo, the ovule becomes a seed, and the ovary and its lower part swells up and becomes juicy and fleshy, producing a fruit.

In some trees the sexes are entirely separate; there are male trees which produce male flowers only and there are female trees which produce female

flowers only, as in the case of papaya and date palm. In castor-oil plant the male and female flowers are found on the same plant, the female flowers at the bottom of the stalk, and the male at the top. Similarly, in maize plant the male flowers are found at the top and the female flowers which develop into the cob are found below. In most plants however the male and female parts, the stamens and the pistil are found in the same flower and such flowers are bisexual. In these bisexual flowers, the anthers and the ovules mature at the same time, the male cells of the same flower may fertilize the eggs in the ovules of the ovary, and such flowers are called self-fertilizing. Thus wheat and peas are self-fertilized. In most of the plants with hermaphrodite flowers the stamens and pistils mature at an interval and so self-fertilization is precluded, and cross-pollination takes place through the agency of wind or insects. Thus crops like maize, *bajra*, *sarson*, *toria* and vegetables such as cabbage and cauliflower are extensively cross-pollinated and are almost totally self-sterile.

Variations and new plants

Variations occur in all plants and animals. In fact we find so many variations even in the same tree that it is difficult to find two exactly similar leaves. Variations are of two types : those which are inherited, and those which are not inherited. The latter are of no importance and are the result of environmental factors. Thus if a plant is heavily manured its leaves may become bigger but the colour, size and form of flowers will remain the same. On the other hand sudden change may take place in its chromosomes, in their number or chemical or physical constitution, thus resulting in double flowers or colour change. Such a variation is inherited. Where a variation results spontaneously due to gene change in the chromosomes it is called a 'Gene Mutation.' This is not due to direct effect of cultivation, nor is it due to hybridization. Thus a pink-flowered variety may give rise to a white-flowered form. Most of the new varieties of flowering plants have resulted from gene mutations, and it is not unlikely that our own species *Homo sapiens* originated in the same way by a chain of gene mutations occurring in the chromosomes of anthropoid apes.

Mutations

Mutations are the most important events in the organic world and are of different degrees—strong and weak, good and bad. Benign mutations enable a species to maintain itself better and survive in the struggle for existence. From an agricultural standpoint, beneficial mutations would be those which would result in higher yield, and greater disease-resistance. During the course of milleniums that the cultivated and wild plants have survived, countless mutations have occurred, and have resulted in new varieties of plants.

Some examples of agriculturally useful mutations in crop plants may be cited. In the Central Provinces a farmer found a new type of grain in his crop of ordinary gram. It was more or less round like a pea and had light orange colour. He multiplied the new type and found that it fetched higher price in the market due to its attractive colour and better parching quality. Here is a case where a mutation proved agriculturally useful. Another farmer in the same province found a gram plant with *green* grain in a field of ordinary gram. The ripened grains of this gram are green unlike those of ordinary gram; and the husk is also green. The green gram fetches higher price on account of its unusual appearance and due to the fact that green colour gives people an impression that they are using unripe grains. Both these variations arose as mutations. Recently a mutation affecting the growth habit in chilli was discovered by Dr. Deshpande at the Indian Agricultural Research Institute. The mutant plant has short branches and compact habit of growth and the fruits are borne in clusters. The mutant is smaller than the ordinary plant, and, therefore, it should be possible to grow more plants per acre, thus resulting in increased yield per acre. Sometimes certain mutations occur which help to distinguish one improved variety from another. In an improved variety of tobacco, N. T. 5, which has pink flowers, a mutation arose which had white flowers. Since ordinary varieties of tobacco have pink flower the white flowered mutation would greatly help in distinguishing mixtures of ordinary tobacco plants.

Cause of mutations

What is the cause of mutations? Can we experimentally induce mutations? There must be numerous causes which induce mutations and their study is of very great importance. Once we master the causes, we will be able to induce mutations experimentally, and thus to control and direct the evolution of domesticated plants and animals, including that of our own species. Muller has found that X-rays increase the rate of mutations in *Drosophila*. The rate of mutations in *Antirrhinum* is considerably accelerated by the use of X rays, chemicals and heat. Baur discovered that in *Antirrhinum* as many mutations were found in the year following X-ray treatment as had occurred in the whole of previous twelve years.

Polyploidy

Apart from gene mutations which we have already discussed above 'Polyploidy' is another fruitful source of new varieties and species of domesticated plants. Sometimes it happens that the chromosome complement of egg cells of plants does not get reduced. In such cases when fertilization occurs we get an embryo with three times the number of chromosomes of the parent plant. Such plants are called 'Triploids.' Triploids are common among plants which are vegetatively reproduced by means of bulbs, corms, and tubers or cuttings, grafting or budding. Most of the Japanese double cherries are triploids. These are highly sterile and produce only flowers and no fruit. As these cherries do not

exhaust their energy in the production of heavy crops of fruit, they flower profusely from year to year.

Sometimes reduction division fails both in the male and female apparatus of reproduction and the plant which results has double the number of chromosomes of the parent plant. Such plants are called 'Tetraploids.' If the same story is repeated again, the number of chromosomes is quadrupled and the plant resulting is called 'Octaploid'. There is a tetraploid race of *Primula sinensis* with 48 chromosomes, while the usual number for the species is 24 only. We also get 'Octaploids' among plants from Tetraploids. *Dahlia variabilis*, with its wide range of colour, is an octaploid which arose in nature from hybridization between two types of tetraploid species followed by chromosome duplication.

Increase in the number of chromosomes is usually followed by increase in the size of flowers, and in some cases of fruit also. Thus the tetraploid forms of *Primula sinensis*, *Campanula*, the triploid tulips and hyacinths, the tetraploid pears, and octaploid garden strawberries are much larger than the corresponding diploid forms.

As polyploidy usually results in increase in size, it has great importance in raising new types of flowers and fruits. Can it be experimentally induced? Yes. Any chemical which inhibits spindle formation in reduction-cell-division will lead to doubling of chromosomes. Colchicine is a drug of this type. Nebel and Tuttle have obtained tetraploids in tomato, marigold and *Dianthus* by the application of 0·4 per cent solution of colchicine in cotyledon stage. This resulted in the production of tetraploid shoots. This is a very important discovery and its application on a wider scale will result in the production of many new types of plants.

Hybridization

In the seclusion of an obscure monastery at Brunn in Austria, Gregor Mendel, an Austrian monk was quietly unravelling the mystery of hybridization and discovered his famous laws of heredity. After eight years' hard work on the common garden pea, *Pisum sativum*, he published his findings in 1865, in an unknown local journal of science. This paper on which the foundation of the modern science of Genetics is laid remained unnoticed till 1900, when De Vries and other botanists rediscovered the laws of heredity on their own.

To illustrate Mendel's law of heredity let us take the case of the common plant, Marvel of Peru (*Mirabilis jalapa*). By crossing a red with a white flower, we get a hybrid with pink flowers. In the second generation we get 25 per cent reds, 25 per cent whites, and 50 per cent pinks. While the reds and whites breed true and produce red and white flowers respectively in the third generation, the pinks segregate again in the Mendelian ratio given above.

The colour which prevails in the first generation is called 'Dominant'. In this case red colour is 'Dominant', and white is 'Recessive'. In man, curly hairs are dominant and straight hair recessive, and brown eyes are dominant and blue eyes recessive. On the other hand in the cattle hornless condition is dominant to horned, and in pigeons black colour is dominant to blue.

Hybridization merely results in mingling of chromosomes of two different species. It is merely the reshuffling of the same set of cards and not the introduction of new cards. New cards are only introduced by gene mutations while hybridization merely ensures a new combination. Even this has given rise to new races of cultivated plants, as in *Rhododendron*, *Iris*, *Vitis*, and *Rubus*. New characters are produced as a result of gene mutation and are presented in the form of new combinations by hybridization. It is thus that in Sweet Pea (*Lathyrus odoratus*) numerous varieties have arisen from a single wild species with purple bicoloured flowers. The same is the case with our other familiar garden plants.

When a plant breeder is assigned the task of improving a crop, he immediately exploits the *existing* variability in a crop plant. By undertaking selection of the *desirable* individuals, the required improvement is brought about. Sometimes it so happens that in the variety under improvement, not all the desirable characters are present, and therefore with respect to the character which is lacking, no improvement is possible. In such cases the plant breeder resorts to hybridization of the variety under improvement with another in which the required character is present, although the latter may not be suitable from other view points. We may enumerate a few instances.

Sugarcane : Most of the sugarcanes grown at present throughout India consist of synthetic varieties. These have been obtained by hybridization between different species or well-known varieties. The original varieties of canes in India such as Paunda of North India, Pundia of Bombay and Poovan of South India were good cane varieties but had certain defects. Botanically these varieties are now known as *Saccharum barberi* and because they have thicker stems than the wild cane *S. spontaneum*, they are generally known as thick canes. Thick canes have a higher sugar content, but are susceptible to many diseases, and because of their softer rind are also attacked by wild animals like pigs and jackals. On the other hand, the wild cane, the weed known as *kans* is very hardy and resistant to various diseases. The hybridization of sugarcane with the wild and other thick cane species, has resulted in the succession of an extensive array of improved sugarcane varieties which were developed by Sir T. S. Venkatraman at the Sugarcane Breeding Station, Coimbatore, Madras, during the last 30 years. At present the two

sugarcane strains Co. 419 and Co. 421 bid fair to become universal varieties in India. We may illustrate the behaviour of Co.419 which has an average yield from 55 to 60 tons per acre. The cost per ton of sugarcane produced by Co. 419 comes to about Rs. 6 as compared to the cost of Rs. 8 to 9 per ton of such varieties as 247B (J247) and P.O.J. 2728. This cane adapts itself to varying conditions of soils and climate. Co.419 produced from a cross between P.O.J. 2827 and Co. 290, two of the most famous varieties of the world, has been found to be more suitable for Southern India. The other variety, Co.412, has found favour in the Punjab and the Uttar Pradesh.

Cotton : In the southern part of Bombay a cotton breeder selected two strains of cotton and named them Dharwar-I and Dharwar-II. The former was superior in various agricultural characters over the local variety, but was susceptible to *Fusarium*, a disease which causes wilting of the plants in the fields. The other variety, D-II was, however, resistant to the disease to a very high degree under field conditions, although in other agricultural characters it was not so good as Dharwar-I. The cotton breeder crossed these two strains and obtained a synthetic type which combined the desirable characters of Dharwar-I and the field resistance of Dharwar-II. The new type has spread over an area of seven lacs of acres in Bombay-Karnatak. This synthetic variety was named Jaywant, i. e. victorious.

Hybrid vigour

Shull and East discovered that inbreeding of maize separated this highly heterozygous plant into a number of pure lines, and these inbreds were invariably poor in vigour and yield as compared to the original open-pollinated variety from which they were derived. However when the inbreds were crossed among themselves vigorous F_1 hybrids were produced which far exceeded the yield of the original variety. The yield increases obtained in the U. S. A. are 40 per cent or more. Besides maize, agricultural utilization of hybrid vigour is possible in tomatoes and the egg-plant.

Thus through the efforts of geneticists and plant breeders who have made not only two ears grow in place of one, but also two bigger ears, we are moving towards the Age of Plenty. They are making use of gene mutations, polyploidy and hybridization and thus forcing the pace of evolution of domesticated plants and animals. Time will come when we will be able to control these processes, and will thus ultimately control the destiny of our own species.

CHAPTER 26

Ornamental, Flowering, Foliage and Shade Trees

STRICTLY speaking all trees which are not cone bearing are flowering trees. In some trees the flowers are brightly coloured as in Gul Mohur and *Spathodea*, and in others they are small, inconspicuous and green as in Asokan. Trees which have showy flowers deserve to be classified as "Ornamental Flowering Trees" to distinguish them from trees with inconspicuous flowers which are otherwise desirable on account of their beautiful foliage and have been classified as "Ornamental Foliage Trees". While most of the ornamental flowering trees are deciduous, and a few are evergreen, nearly all the ornamental foliage trees are evergreen. Some of the ornamental foliage trees are particularly suitable for planting as shade trees along roads and in parks on account of their thick spreading crowns.

A scrutiny of the lists of ornamental flowering trees shows that only a few are indigenous, and the majority are exotics introduced from foreign countries like Madagascar, South Africa, Tropical and South America, Java, Malaya, Burma and China. While some of these trees like Gul Mohur and Gul-i-Chin have become fairly popular, there are a number of others which are still unknown to the layman, as no effort has been made to popularize them by propaganda. Boys and girls in schools

should be taught the names of these beautiful trees and parties of school girls and boys should be taken to public gardens to show them these trees when they are flowering. The average man has an aversion for complicated Latin names. Latin botanical names have their merit, particularly on account of their international use and accuracy. On the other hand, popular names are often vague and have been differently used by various persons. If mental laziness is overcome one should have no difficulty in mastering botanical names. Even illiterate 'Malis' learn to pronounce difficult English and botanical names in a comparatively short time; so there is no valid reason why educated persons should find much difficulty with them.

Though Latin names are to be preferred on account of their accuracy and international usage, there is no harm in having popular names in simple Hindustani as well. Most of our indigenous flowering trees have Indian names and these require only to be popularized. On the other hand, there are a number of foreign trees which have no Hindustani names. For these the present author has invented new names, and these can be easily popularized in schools, universities and gardening institutions. Name plates with both Latin and Hindustani names should be fixed on selected specimen trees in all our public parks and gardens, so that the common man too, may learn to identify them rather than stand and gape in wonder at indecipherable Latin names.

1. Ornamental Flowering Trees.

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering	Description.	Gardening Notes.
1-1	Apocynaceae	Plumeria *P.acutifolia* Poir.	Pagoda Tree / Gul-i-Chin	White. March, April and July to October	A small tree, 10-12 feet high; bare stem; crooked branches bearing terminal clusters of broad lanceolate leaves, capped with large corymbs of fragrant flowers. Native of Mexico and Guatemala.	Easily propagated by cuttings in July and August. Allow the cuttings to wilt before planting. Can thrive in sandy and stony soil with a rainfall of 25 inches or upwards.
2.	do.	*P. rubra* Linn.	Frangi-Pani / Lal Champa	Red do.	Has red flowers.	

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering.	Description.	Gardening Notes.
3.	Apocyanaceae	*P. alba* Linn.		White March, April & July to October.	A dwarf tree bearing clusters of dark-green ovate leaves. It is the prettiest tree of the genus *Plumeria* and is almost evergreen.	Propagated by cuttings. There are a number of hybrid plumerias designated by such names as 'tuberculata magnifica' 'lutea,' 'Rene', etc. available at the Royal Agri-Horticultural Society's Garden at Calcutta. I have seen a few of them in flower, and some are very fine, with flowers distinctly larger than in the commonly grown varieties.
4.	do.	*Wrightia tinctoria* R. Br.	Dudhi	Red May	A small tree with ivory-white stem which bears numerous red flowers scattered among leaves in the month of May.	
II-5.	Bignoniaceae	*Bignonia crispa* Buch-Ham.	Padiri / Padiri	White May-June	A very handsome tree with drooping boughs, glossy leaves and funnel-shaped delicately fragrant flowers.	A South Indian tree, also grows in Bengal. Suitable for moist districts only.
6.	do.	*Jacaranda mimosaefolia* D. Don.	Jacaranda / Nili Gul-Mohur R.	Violet blue March-April	A small tree, 15-30 feet high with fern-like bi-pinnate leaves, and loose pyramidal panicles of 40-100 blue flowers. A native of Brazil.	Propagated by seed. Suitable for dry areas. Stands pruning well. Starts flowering at the age of 5 years and after 20 years becomes ugly and should be headed off. Quite common in the compounds of houses, particularly those of Secretariat bungalows at Lucknow, at Forest College Dehra Dun, and New Delhi.
7.	do.	Spathodea *I.S.campanulata* Beauv.	The Fountain tree or Scarlet Bell Tree or Tulip Tree	Orange-crimson February-March	A tall tree growing to a height of 70 feet, large odd pinnate leaves; gorgeous terminal panicles of erect orange-crimson flowers. A native of Tropical Africa. One of the finest trees for scenic planting.	Appears very attractive when grown in clumps or avenues. Can be seen at its best in Willingdon Sports Club Bombay. Suited to districts with 20-40" of rainfall. Easily propagated from root-suckers or from cuttings. Also raised from seed. Demands rich, well-drained soil. Widely planted in Hyderabad(Deccan).
8.	do.	*2. S.nilotica* Seem.	do.	do.	Smaller tree with bright flowers. More beautiful than *S. campanulata*.	There are 5-6 trees behind Victoria's statue, in Alfred Park, Allahabad, which are a glorious sight in March.

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering.	Description.	Gardening Notes.
9.	Bignoniaceae	*Tecomella undulata* Seem. *Tecoma undulata* G. Don.	Wavy-leafed Tecomella / Lahiru	Orange yellow March-April	A small tree; leaves greyish green with wavy edges; flowers large, orange yellow, in bunches of 5-10 at the ends of small lateral branches, very handsome when in full bloom.	Easily propagated from seed or cuttings. Flourishes in dry districts.
III-10.	Boraginaceae	*Cordia sebestena* Linn.	Scarlet Cordia / Lal Lasoora R.	Orange-red or scarlet January-March or throughout the year	A small tree of dwarf habit and compact growth, rarely more than 15 feet high, wrinkled leaves; flowers orange-red in large open clusters at the ends of branches. Imported from Cuba and Tropical America.	Propagated by seed or by layers.
IV-11.	Capparidaceae	*Crataeva religiosa* Forst F. (*C.nurvala*)	Caper tree / Barna	White April	A small tree 10-12 feet high, crooked branches; becomes laden with pale yellowish flowers in the last week of April. It flowers in leafless condition and is very pretty indeed. Is suitable for planting in triangular plots in towns.	It is a very hardy and drought resistant tree. Raised from seed in monsoons. Common in the U. P. Can be seen at Lucknow. Frost-tender and slow-growing.
V-12.	Dilleniaceæ	*Dillenia indica* Linn.	Chalta	White July	An erect ever-green tree, 30-40 feet high, rounded crown; leaves broad, pointed, with toothed margin. Flowers large, white and fragrant, borne singly at the ends of branches in July. Common in Bengal and Bihar.	Propagated from seed sown in monsoons. Suitable for moist localities. Frost-tender.
VI-13.	Lythraceae	Lagerstroemia *1. L. flos-reginae* Retz.	Queen's flower or Pride of India / Jarul	Mauve-purple or Mauve-pink April-May July-August	A small-sized evergreen tree with light grey smooth bark. In moist districts it is a large tree but in dry districts it is seldom 15-20 feet high; flowers when only shrubby in size; mauve purple or pinkish flowers in terminal panicles 1-2 feet high.	Grown from seed; a moisture-loving tree, does well on river banks. Commonly cultivated in Gorakhpore district. There are some nice specimens of this tree in Sikandar Bagh, Lucknow. Transplant when one year old, flowers 3-5 years after planting. Heavy pruning of side-branches is necessary.
14.	do.	*2. L.thorellii* Gagnep	do / Bari Sanwani R.	White and mauve. July-September	A dwarf bushy tree with mottled mauve flowers.	Easily grown from seed. Can be seen in Sikandar Bagh, Lucknow.

Bauhinias are covered with a mantle of mauve flowers in the month of March.

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering.	Description.	Gardening Notes.
VII-15.	Legum-inosae.	*Amherstia nobilis* Wall.	Noble Amherstia	Orange & Yellow November & April	A medium-sized tree with drooping leaves with sprays of orange and yellow flowers.	Considered by some to be the most beautiful of all the flowering trees. Native of Burma. Flourishes in Bengal and other humid localities. Dies in north India on account of hot dry winds and frost.
16.	Legumino sae. Papiliona-ceae	*Butea frondosa* Roxb. *B. monosperma (Lam)* Kuntze	Flame of the forest / Dhak, Palash	Scarlet-orange. February-March	A common jungle tree, which covers acres of waste-land. In the months of February and March, it flowers in leafless condition, and becomes covered with flaming scarlet-orange flowers with black calyces. Varieties with canary yellow and apricot colour flowers have been recorded.	Propagated from fresh seed, which germinate easily.
17.	Caesal-pinioideae	Bauhinia *1. B. purpurea* Linn.	Mountain Ebony Purple Bauhinia / Gulabi Kachnar R.	Purple to Lilac or Red November	A medium-sized evergreen tree. A very beautiful tree which deserves greater popularity. The only defect is top drying of branches.	Flourishes in high well-drained soil. Easily affected by low temperatures. Sow the seeds in lines in the beginning of the monsoons. Transplant from nursery in the first year. Branches which lean out should be cut.
18.		*1. B.tomentosa* Linn.	Kachnar	Pale yellow	An evergreen shrubby tree bearing numerous pale yellow flowers during rainy months.	
19.	do.	*2. B. triandra* Roxb.	Pink Bauhinia / Lal Kachnar R.	Pink October & November	A small bushy tree with pinkish flowers.	
20.	do.	*B. variegata* Linn.	Kachnar (Baisakhi)	Pink, white and purple varieties. February March	Flowers white with light yellow spots or pink with red spots or purplish, appearing when the tree is leafless.	It is a very beautiful tree and an avenue of these three varieties along with *B. Krugii* is lovely.
21.	do.	*4. B. acuminata* Linn.	Safed Kachnar	White All the year	A small tree about 10 feet high, nearly always in blossom with numerous white flowers.	Grown in Sikandar Bagh Lucknow.
22.	do.	*5. B.corymbosa* Roxb.	do.	Rosy white April	A scandent shrub with small leaves.	

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering.	Description.	Gardening Notes.
23.	Caesalpinia-oideae	*6. B. alba* Buch-Ham.	Safed Kachnar	White April	A dwarf round-headed tree.	
24.	do.	Brownea *1. B. coccinea* Loefl. ex Griseb.	West Indian Mountain Rose	Scarlet Red March	A small tree 8-10 feet high of handsome compact growth; with dazzling heads of scarlet flowers. There is no mass flowering however.	Propagated by layers; does well in moist climate. There is a handsome specimen in Sikandar Bagh Lucknow. Unsuitable for northern India as it is killed by 'loo'—Can only be grown in sheltered spots.
25.	do.	*2. B. ariza* Benth.	do.	Rose-red March	A small spreading tree with beautiful foliage. Leaves droop in heat.	
26.	do.	*3. B. grandiceps* Jacq.	Rose-of-Venezuela	Bright-Red March	Native of West Indies. A large-headed variety, mottled foliage.	Should be grown in a sheltered shady place.
27.	do.	Cassia *1. C. fistula* Linn.	Indian-Laburnum or Golden shower / Amaltas	Yellow April-May	A small hardy tree, sheds its leaves in March, and produces pendulous racemes of large bright yellow flowers in April and May. Young leaves coppery-red.	A very common tree found wild at the foot of the hills of U. P. and Assam. Can be seen to best advantage in Lucknow. Makes a beautiful avenue. Hardy, xerophytic, not eaten by goats. Boil the seeds for 5 minutes before sowing to soften the hard coat. Transfer the seedlings to baskets in first rains. Will grow in poor soil. Suitable for dry or moderately wet districts.
28.	do.	*2. C. javanica* Linn.	The Java cassia / Java Ki Rani R.	Pink May-June	A native of Malay Islands, bears clusters of pink flowers.	
29.	do.	*C. nodosa* Ham.	Pink-Mohur	Pink May-June	A tree with a spreading crown. Flowers in big pink clusters appearing like bunches of roses on long branches. When the tree is in flower it appears like a huge bouquet of roses. It is the most beautiful of all flowering trees, flowers in the leafless condition and leaves appear in the lower branches first. It is at its best in the month of June. A native of Burma and Malaya.	Stake the young trees as they have a tendency to lean over. There is a beautiful specimen in front of the Taj Mahal at Agra. and one in front of the Superintendent's office in Sikandar Bagh, Lucknow. Suitable for moist localities. Can also be grown in dry districts in sheltered spots where the tree can be saved from hot winds.

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering.	Description.	Gardening Notes.
30.	Caesalpinioideae	*C. renigera* Wall.	Burmese Pink Cassia	Pink, May-June	Medium-sized, 18-20 feet Introduced from Burma.	Common in Bombay city. Prefers a moist climate.
31.	do.	*Colvillea racemosa* Bojer.	Colville's Glory / Kilbli	Orange to Red. July-August to October.	Pinnate leaves and umbrella-habit as in Gul Mohur; flowers orange to red in colour, in large drooping clusters. A native of Madagascar.	Propagated from seed, suited to moist or moderately dry low country. There are three trees in Alfred Park, Allahabad, which flower in October. Flowers appear in a scarlet fringe on the top of the crown and are a glorious sight.
32.	Leguminosae. 2. Papilionaceae.	Erythrina *1. E. indica* Lam. Var. *parcelli*	Coral tree	Scarlet-red. February-March	A small quick growing tree with variegated leaves. Racemes of scarlet flowers appear in clusters at the ends of branchlets before the leaves.	Propagated from cuttings 3 feet long, 3 inches across. There is one plant in Alfred Park, Allahabad. Common in Bihar and Bengal.
33.	do.	*2. blakei* Hort.		Cinnamon red. April.	A small tree with brilliant scarlet flowers. It is the most beautiful tree of the genus.	There is a nice shrubby tree of *E. blakei* in Sikandar Bagh, Lucknow, in front of the Superintendent's Office.
		3. E. cristagalli Linn.		Deep red, April.	A dwarf tree bearing a profusion of deep red flowers. It is a very attractive tree. A native of Brazil.	Government Nursery, New Delhi.
34.	do.	*Gliricidia maculata. H. B. K.*	The Madre tree	Pale-pink, February-March	A small quick-growing tree, long feathery leaves, leaf-fall in February, followed by sprays of pale-pink flowers, which resemble those of Wistaria.	Easily raised from seed or cuttings 5-6 feet long. Wood is brittle, the tree should be pollarded from time to time to keep it dwarf. A native of Tropical America.
35.	do.	*Milletia ovalifolia* Kurz.	Moulmein Rose-wood	Lilac. March.	A small tree with beautiful lilac-coloured flowers appearing in leafless condition entirely covering the tree. Its mauve and lilac pendulous racemes are a glorious sight.	It grows in Sikandar Bagh, Lucknow, and Khusru Bagh, Allahabad. Raised from seed.
36.	Papilionaceae	*Enterolobium saman* Prain.	The Rain Tree	Pale-pink. March-September.	A large tree with pinnate leaves. grows very rapidly; flowers appear in pale-pink clusters.	Suitable for planting in exposed places, a wind-resisting plant, provides quick shade, suitable for avenue planting. Propagated, by seed, sown in rains.

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & flowering period.	Description.	Gardening Notes.
37.	Papilionaceae.	Peltophorum; *P. ferrugineum* Benth. *P. inerme* Llanos.	Rusty Shield bearer	Bright-yellow. March to May and September to November.	A big tree 40-80 feet high with feathery-pinnate leaves; leaf-fall in January. Young leaves grow in February when the tree becomes covered with profusion of yellow flowers; it flowers twice in the year. A native of Ceylon.	A highly ornamental tree, very effective when planted alternating with Gul Mohur its bright yellow crowns contrasting with scarlet heads of Gul Mohur. Easily propagated from seed. There are some trees in Alfred Park Allahabad which appear highly ornamental with golden yellow flowers in October.
38.	Caesalpinioideae.	*Saraca indica* Linn *Jonesia asoca* Roxb.	Asoka tree / Sita Asoka R.	Orange-red February March.	An ever-green tree with branches spreading in all directions; flowers in large compact clusters, on opening they are orange coloured then turning red contrasting with the deep green foliage. Hindus regard it as sacred, dedicated to Kama Deva, God of Love.	A very handsome tree with a thick shade. On account of its spreading habit it should be grown in a clump in an open space. Grown from seed. Some people regard it as the prettiest Indian tree. There is a handsome specimen in Khusru Bagh Allahabad.
39.	do.	*Poinciana regia* Bojer (*Delonix regia*). Raf.	Gul Mohur Flamboyant	Scarlet orange-red April-June.	A spreading umbrella like tree, pinnate feather-like leaves; leafless in March and in April it is a brillant mass of scarlet flowers. A native of Madagascar.	A very common tree especially at Lucknow. Seeds should be soaked in hot water for 8 minutes before sowing. Also grown from cuttings A beautiful avenue tree; especially when grown alternating with Amaltas.
40.	do.	*Poinciana elata.* Linn.	White Gul-Mohur Sankesar.	Yellow white. February-March	A short and stumpy tree with umbrella-like crown. Gets laden with yellow-white flowers in February-March, which provide a pleasant contrast with its bright green feathery leaves. Commonly grown in the Central Provinces. Introduced in India by the Arabs from Abyssinia.	
41.	Papilionaceae.	*Pongamia glabra.* Vent.	Karanj	Mauve. April-May.	A drawf deciduous tree, with trifoliate shiny Sheesham-like leaves; flowers in leafless condition in the last week of Aprll when it is laden with lilac or mauve flowers which resembie those of Milletia. Appears very pretty when flowering. Provides excellent shade. Suitable for platforms of railway stations.	Is raised from seed in rains. It is a sight in May when laden with flowers.

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering.	Description.	Gardening Notes.
42.	Papilionaceae.	*Pterocarpus indicus* Wild.	The Padauk Tree. Padauk.	Golden yellow. May-July.	A tall tree 40-50 feet high, bears recemes of orange-yellow flowers in early rains. Flowers are very short-lived.	A native of Burma and Malaya. Suitable for moist sea-side districts of South and East India. Propagated from seed.
43.	do.	*Sesbania grandiflora* Poir.	Agastya.	Cream or Pink. December.	A small quick growing tree; pinnate leaves; two varieties; one with salmon pink flowers and the other with cream-coloured flowers of comparatively large size borne singly. Flowers eaten in the form of 'Pakoras'. Pods long and unsightly and should be plucked off.	Raised from seed in rains. Yields a nice hedge in a year and flowers the same year.
VIII-44.	Bixaceae.	*Cochlospermum gossypium* D. C.	Yellow silk-cotton tree / Gooloc.	Deep yellow, February-March	A small tree 8-18 feet high. Golden yellow flowers appear when the tree is leaf-less.	Flourishes in dry areas being a xerophytic plant.
IX-45.	Malvaceae.	*Hibiscus collinus* Roxb.		Rose-pink with dark puce-coloured eye. Nov.-Dec,	A small tree with spreading branches and trilobed heart-shaped leaves.	A very ornamental tree which looks very pretty on a lawn. There is one tree in Gulabbari park Fyzabad.
46.	do.	*Kydia calycina* Roxb.	Roxburgh's Kydia.	White September October.	A small tree with large irregularly heart-shaped leaves, bearing panicles of white or pinkish flowers.	Propagated from seed—in nursery. Transplant seedlings when 2-3 inches high. Quick growing tree.
47.	do.	*Chorisia speciosa* St. Hill.	Mexican Silk-Cotton Tree.	Light yellow. October.	A beautiful tree with bottle shaped green trunk. It bears numerous light-yellow flowers in leafless condition in the month of October. Commonly grown in Lucknow and Dehra Dun.	It is a fast-growing tree which begins flowering in about 5 years. Raised from seed. Sown in rains.
48.	do.	*Thespesia populnea* Soland ex Correa.	Portia tree, Bhendi tree, Tulip tree / Bhindi.	Yellow & Cinnamon red. All the year round.	A large evergreen tree with glossy dark green poplar like leaves, flowers appear singly off and on throughout the year Grows to a height of 30-40 feet.	Easily raised from seed or cuttings. It has a crooked stem and is suitable for medium-sized gardens. Prefers a light porous soil. There are many trees opposite Municipal Museum, Allahabad, which flower profusely in October.

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering.	Description.	Gardening Notes.
X-49.	Ochnaceae.	*Ochna squarrosa.* Linn.	Khambar	Bright yellow, May. Blue,	A small tree bearing bright yellow flowers in early May. Fairly pretty.	Raised from seed and cuttings in monsoons.
XI-50.	Zygophyllaceae.	*Guaiacum officinale* Linn.	Lignum Vitae Tree =Tree of Life.	March & November.	A shrubby tree with small dark-green leaves. It bears clusters of bright blue flowers in great profusion in the months of March and November. The colour of the flower fades from deep blue, to light blue, the variegated pattern of colours-producing a beautiful contrast with the dark-green leaves. Introduced from West Indies.	Raised from seed.

II - Uncommon Flowering Trees Which Deserve Greater Popularity.

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering.	Description.	Gardening Notes.
I-1.	Araliaceae	*Brassaia actinophylla* F. Mucll.		Crimson, July.	A small tree with large radially-divided leaves, with a terminal inflorescence of several radiating spikes 3—4 feet long.	A native of Queensland in Australia, suitable for moist districts.
II-2.	Bignoniaceae.	*Tabebuia* i. *T. rosea* D. C.		Pale mauve, June.	A small erect tree, palmately 5—leaved, producing beautiful pale mauve flowers.	A native of Mexico suited for moist localities. Grown from seed in monsoon.
3.		ii. *T. spectabilis* Nichols.	Basant Rani R.	Yellow, March-April.	A small tree gets covered with bright yellow bell-shaped flowers when leafless in spring. Flowers drop in morning forming a bright yellow carpet below the tree.	A native of Venezuela. Suited for moist localities. Grown from seed in rains.

Serial No.	Natural order.	Botanical name.	English & Indian name.	Colour of flowers & period of flowering.	Description.	Gardening Notes.
III-4.	Bixaceae	*Oncoba spinosa* Forsk.	Bride of the desert / Arbi-Dulhan	White, April-May.	A small bushy tree with light-green ovate leaves. Bears large white, solitary, sweet-scented flowers.	Native of Arabia, suited for dry areas.
IV-5.	Guttiferae	*Mesua ferrea* Linn.	Ceylon Iron-wood tree / Naka, Nagkesar	do.	A medium-sized tree, produces large white flowers with a central bunch of yellow stamens. Young leaves are deep crimson above and silvery below.	Grown in Ceylon near Buddhist temples. Suited for hot and moist areas.
V-6.	Leguminosae.	*Boulsanthus speciosus* Harms.	Rhodesian Wistaria / Gul-i-Nilam	Deep blue.	A beautiful slow-growing tree with glossy dark green pinnate leaves. It bears drooping Wistaria-like racemes of most beautiful deep-blue, sweet-scented, flowers.	A native of Rhodesia, South Africa. Propagated by seed in rains.
7.	do.	*Lysidice rhodostegia*	Rose of China / Hance.	Rose-purple, January-February.	A large-handsome tree with pinnate leaves, bearing erect loose panicles of rose-purple flowers with pink scaly bracts which persist after the shedding of flowers.	A native of South China, thrives in moist localities.
8.	do.	*Pterocarpus echinatus* Pers.		Orange yellow, April-May.	A medium sized tree with large clusters of pale-orange-yellow-flowers which look very pretey.	A native of Philippines, also grows in Ceylon.
9.	do.	*Pterocarpus indicus* Willd.	Padauk or Senna / Padauk.	Yellow, March-April.	A tall and handsome tree with a round spreading crown, long drooping branches and pinnate leaves. Yields fine timber.	A native of Andamans suitable for big compounds or parks. Suitable for moist districts.
10.	do.	*Saraca declinata* Miq.		Orange yellow, February-March	A small tree with large heads of bright orange-yellow flowers borne on the stem and main branches.	A native of Sumatra. Very striking when in flower. Thrives in shady and sheltered situations. Suitable for moist districts.
11.	do.	*Schizolobium excelsum* Vog.	Basanti R.	Bright-yellow, February-March	A large quick-growing tree with feathery bipinnate leaves. Flowers borne on large erect sprays when tree is bare.	A native of Brazil, suited for moist localities.
VI-12.	Proteaceae	*Stenocarpus sinuatus.* Endl.	Tulip Tree of Queensland.	Scarlet, May-July.	A tall erect tree, bearing clusters of showy scarlet flowers.	A native of Australia, suited for moderately moist places.

III. Trees with Ornamental Foliage.

Serial No.	Natural order.	Botanical name.	Engligh and Indian names.	Description.	Gardening Notes.
I-1.	Annonaceae	*Polyalthia longifolia* Benth. and Hook f.	The Mast tree / Asokan.	Tall evergreen tree with a symmetrical pyramidal crown; beautiful glossy light green leaves in great profusion, translucent when young flowers greenish inconspicuous in March; fruits July, Native of Ceylon and Bengal.	This tree is very graceful and is suitable for planting in avenues. Grown 15 feet apart on the southern side of the compound wall they afford a very good protection from the heat of the sun, and a act as wind-break. A very common tree in Oudh and Allahabad. Seeds sown in July. Sow in flower pots. Plant out when of suitable size. Can be easily headed off.
II-2.	Burseraceae.	*Filicium decipiens* Thw.	Fern Tree.	An evergreen tree of medium size, with ornamental fern-like leaves; crown compact and globular.	An exceptionally good tree for grouping or small avenues. Propagated by seed.
III-3.	Combretaceae.	*Anogeissus pendula* Edgew.	Dhao.	A very ornamental medium-sized tree with drooping branches and small leaves. Stem white.	Suitable for avenues. Obtainable from Govt. Gardens Saharanpur.
IV-4.	Euphorbiaceae.	*Phyllanthus emblica* Linn.	Amla.	A very handsome medium sized tree with beautiful feathery leaves, and mottled stem. Fruit is pickled and has high vitamin C value.	The grafted variety from Banaras is exceedingly handsome. Suitable for planting in avenues and groves.
5.	do.	*Putranjiva roxburghii* Wall.	The child life tree / Putranjiva or Jiva Puta or Patju.	A very handsome large evergreen tree with a semi-globular crown ; dense glossy foliage on semi-pendulous branches; resembles *Polyalthia* in habit. Flowers inconspicuous, March-May.	Suitable for planting in avenues. Easily trans-planted from nursery stock. Common in Lucknow. Can be easily headed off.
6.	do.	*Sapium sebiferum* Roxb.	Chinese Tallow Tree / Vilayati shisham.	A medium sized deciduous tree with leaves resembling those of Shisham. In autumn leaves turn bright scarlet and present a beautiful sight. The tree is extremely frost-resistant and commonly grows in Kangra district. Introduced from China.	The seeds are coated with white wax and germinate easily.

Serial No.	Natural order.	Botanical name.	English and Indian name.	Description.	Gardening Notes.
II-7.	Leguminosae.	*Tamarindus indica* Linn.	Imli.	A big evergreen tree with small leaflets, 30-50 feet high and a large spreading crown. Flowers April-June; fruits November December.	Grows well in all localities free from sharp frosts. Grown from seed in March-April, transplanted in monsoons, but of slow growth. Fine specimens of Imli trees can be seen in Guptar Park Fyzabad where they attain a huge size. An excellent tree for road side avenues.
II-8.	Leguminosae, Mimosoideae.	*Acacia auriculiformis* A cunn. ex. Benth.	Australian Phyllode Acacia or Australian wattle.	A very handsome evergreen tree with pendulous branches, and leaf-like phyllodes.	Planted in a clump at the back of the house, it yields a very shady corner suitable for study. Also makes a fine avenue. There are some fine specimens in Alfred Park, Allahabad.
III-9.	Meliaceae.	*Melia azadirachta* Linn.	Neem.	Common tree, about 20-30 feet high. It is a hardy tree and stands pollarding well. If a tree grows too big, cut off the crown from the top of the stem in December or January. New shoots will sprout in March. It sheds its old leaves in March and produces glossy young leaves and fragrant white flowers in the first week of April. The flowers and fruit stink badly after a shower. It is a very shady tree which grows successfully in saline soil even in extreme drought. On account of its large number of leaves, leaf-area is big and rate of photosynthesis is also high. Consequently gives more Oxygen during day time as compared with other trees. Hence its reputation as purifier of air is not unjustified.	Seed of Neem does not keep. It should be sown soon after collection.

Serial No.	Natural order.	Botanical name.	English and Indian name.	Description.	Gardening Notes.
10.	Meliacea.	*Melia azedarach* Linn.	Dake, Bakain (Persian Lilac)	A very fast growing middle sized tree 15-25 feet high with smooth bark and beautiful leaves; soft lavender coloured flowers in March-April; fruits November-December.	Grown from seed in rains. Not attacked by rats or white ants on account of its bitter bark. Rather short-lived. It is common in the Punjab especially around wells fitted with Persian wheels and deserves popularity in the Uttar Pradesh also.
VI-11.	Moringaceae.	*Moringa pterygosperma* Gaertn.	Horse-radish Tree / Sainjan	A handsome quick growing tree with pinnate fern-like leaves. Bears white or cream-coloured flowers from the end of January to middle of February. Pods cooked as vegetable.	Sow the seed in July. This tree stands pollarding very well and new shoots appear very quickly.
VII-12.	Myrtaceae.	*Callistemon lanceolatus* Sweet.	Scarlet Bottle Brush tree / Lal Botal Brush.	A very handsome evergreen tree with pendulous branches as of the weeping willow with clusters of small leaves. Scarlet flowers in March in bottle-brush like tufts. It again flowers in October.	Its graceful 'weeping habit,' makes it suitable for avenue planting. Propagated by seed. A common garden tree in the Punjab and U. P.
13.	do.	*Eucalyptus citriodora* Hook.	Blue gum tree / Sufeda.	Slender trunk, smooth, clean, few branches, lemon scented leaves, evergreen. Flowers May-June. A native of Australia.	Grows rapidly, has a gregarious habit and should be planted in clumps or avenues.
14.	do.	*Eucalyptus flicifolius* F. Muell.		A very ornamental Eucalyptus with a profusion of crimson flowers.	Suitable for avenues.

IV. Shade Trees.

Serial No.	Natural order.	Botanical name.	English and Indian name.	Description.	Gardening Notes.
I-1.	Ebenaceae.	*Diospyros embryopteris* Pers.	Gab.	An evergreen tree with a spreading habit about 25-30 feet high with smooth shining leaves covering its spreading branches Sexes separate. Introduced from China.	There is a fine specimen in Govt. Gardens Saharanpur. Children use the low spreading branches as see-saws. Suitable for public parks.

Serial No.	Natural order.	Botanical name.	English and Indian name.	Description.	Gardening Notes.
IV-2.	Myrtaceae.	*Eugenia cuspidata* Berg.	Jamoah	A medium-sized evergreen-tree with shady crown of bright green leaves and light yellow stem. The tree renews its leaves imperceptibly in the month of March, and the new leaves have an attractive light green colour. A very desirable avenue tree for town roads and is particularly effective when grown alternating with deciduous flowering trees, like Kachnar, Amaltas and Jacaranda. Fruit is sour and small in size.	Grown from seed. This tree has been extensively grown as a road side avenue tree in New Delhi. Alternated with various varieties of *Bauhinia variegata* it looks very pretty.
3.	do.	*Eugenia jambolana* Lam.	Jamun	Is a bigger tree with dark stem and edible fruit.	Grown from seed.
4.	Urticaceae.	*Ficus 1. F. infectoria* Roxb.	Pakur	A large shady tree 35-40 feet high with aerial roots and well-formed deep but low crown providing a thick shade. In April it is covered with delicately-tinted copper-coloured foliage.	Propagated from seed sown in nursery stock or propagated by stumps. Branch cuttings produce trees with a low spreading crown, and ugly stem. Can be seen to its best advantage in Bareilly district, especially along Bareilly Nainital Road. Suitable for most districts.
5.	do.	*2. F. retusa* Linn.	Chilkan R.	A very shady, spreading tree with glossy dark green leaves. It is ever green and the best shade tree available in this country. It is 30-55 ft. high and is as large as a Banyan tree.	Common in New Delhi.

CHAPTER 27

Some Odd and Unusual Trees

IN this age of plans and standardization, the craving for individuality can easily be appreciated. Every individual desires to have some odd tree in his garden to excite the wonder and curiosity of neighbours and visitors. There are some trees indigenous as well as exotic which appeal to this trait of human character.

Of these odd and unusual trees, *Cycas* and *Ginkgo* have special historical and botanical interest. *Cycas* or the so-called Sago Palm is a comparatively common garden tree and is usually mistaken for a palm. It is as much related to a palm as a sea-horse to a horse or a shark to a whale. The sea-horse and the shark are fishes and the horse and the whale are mammals. *Cycas* is nearer to ferns than to palms. Like ferns, the powder-like pollen in male cones produces living motile sperms. Commonly the trees that we notice in our gardens are female plants with woolly female cones bearing scarlet-red ovules. In the Jurassic period when birds were evolving from reptiles there were big forests of *Cycas* and tree-like *Cycads*. At present *Cycas* is a living fossil, survivor of an ancient race of plants which dominated the surface of the earth millions of years ago. Similarly *Ginkgo*, or Maidenhair Tree which has been saved from extinction by the Chinese priests who gave it shelter in their temples, is a living fossil. In this tree too we find, that motile sperms which actively swim about in drops of water are produced as in animals. While *Cycas* is easy to propagate by means of bulbils, *Ginkgo* which is grown from seed is a difficult tree. In Dehra Dun, in northern India it has attained reasonable size.

We may as well mention *Araucaria* which is a distinctive tree and when successfully grown arouses considerable interest among visitors. A native of tropical regions it is grown in pots in cool verandahs. Ornamental

bamboos which are so popular in China, particularly the striped gold-with-green varieties are very attractive and the soil around them can serve as a base for rockeries.

Some of the parks in Lucknow are studded with odd-looking giant trees with swollen trunks. This is the Boabab tree also called Gorakh Imli on account of its association with Gorakh Nath, guru of the kanphata yogis. The yogis use the shell of the gourd-like fruit of Boabab as water pots. This tree is an introduction from Central Africa and thrives in dry areas. With its spreading horizontal branches and swollen hollow trunk tapering suddenly, the Boabab tree appears grotesque and is one of nature's odd creations. It is suitable for planting in spacious parks as well as in the country-side.

There are some trees with unusual type of fruits. The cannon-ball-tree has ball-like fruits studded over the main stem while the candle tree has candle-like fruits protruding from the stem. The sausage tree has sausage-like fruits dangling from its branches.

There are some trees which have odd and unusual leaves. *Ravenala*, the Travellers Tree from Madagascar, has been grown with success in some private gardens in the moist districts of the eastern Uttar Pradesh and in Bihar. It has banana-like leaves arranged in the form of a Japanese ladies' hand-fan One of the most peculiar trees is Krishna's Ficus with leaves joined at the base, giving them cone-like appearance. The legend is that Krishna used leaves of this tree for storing stolen butter.

A list of unusual trees for the gardens of the curious

1. ANGIOSPERMS.

Serial No.	Natural order.	Botanical name.	English name.	Indian name.	Description.	Gardening notes.
I.	Araliaceae	*Trevesia moluccana*			A small tree with very large palmate spreading leaves surrounding clusters of dark purple berries.	It is a tropical tree, a native of Moluccas and is suitable for Bengal and tropical South India only.
II.	Bignoniaceae	*Kigelia pinnata*	Sausage tree	*Jhar-Fanoos*	A medium-sized spreading tree bearing long pendulous racemes of mottled dark purplish red flowers which appear like candelabra. Its fruits are long and sausage—like in appearance with long cord-like stalks.	A native of tropical West Africa which is equally at home even in the cold climate of the Punjab. Propagated by seed.
		Parmentiera cerifera	Candle tree	*Mom-Batti R.*	A small tree with light green leaves. Its cylindrical candle-like yellow fruits are borne on the stem and branches in large numbers twice a year.	A native of Tropical America. Propagated by seed.

Serial No.	Natural order.	Botanical name.	English name.	Indian name.	Description.	Gardening notes.
III.	Malvaceae	*Adansonia digitata*	Monkey bread tree	*Gorakh-Imli*	It is a giant tree with thick smooth trunk with broad base and tapering stem. During hot weather it is leafless, when its much divided crown appears gaunt and grotesque. Introduced in India by the Arabs from Africa	Raised from seed. Planted singly in parks.
IV.	Myrtaceae	*Couroupita guianensis*	Cannon-ball-tree	*Tope-Gola R.*	A remarkable tree with large pink and white fleshy flowers borne on the main-stem. Its brown fruits are globular, about the size of a man's head, resembling a cannon ball.	A native of Tropical South America also found in Ceylon. It flourishes only in a moist tropical climate; propagated by seed.
		Careya arborea		*Kumbhi*	A common forest tree in the C. P. Its copper-red leaves appear very pretty in the month of October. Fruit is pitcher-shaped ; hence the name Kumbhi. Flowers Pink-white, appear with new leaves in April-May.	Raised from seed. Planted singly in parks.
V.	Scitamineae	*Ravenala madagas-cariensis*	Travel-lers tree	*Khajur Pankhi R.*	A remarkable tree which appears like a gigantic ladies hand-fan. Its banana-like leaves are borne in two rows. Grows to a height of 30-40 feet. Its sheathing leaf-stalks form receptacles in which water is stored.	Requires a hot and humid climate being a native of Madagascar though in the U. P. it can grow in shaded and sheltered situations.
VI.	Urticaceae	*Ficus krishnae*	Krishna's Butter cup	*Makhan Katori R.*	A small tree with folded leaves joined at the base which appear like containers of ice-cream (*Kulphis*).	Grows easily in north India.
2. GYMNOSPERMS						
VII.	Cycadales	*Cycas revoluta*			A remarkable tree which produces a crown of palm-like leaves every year. The sexes are separate. The pollen of male cones produces living motile sperms as in ferns and animals. A living fossil.	Propagated by bulbils.
VIII.	Ginkgoales	*Ginkgo biloba*	Maiden-hair tree	*Bal Kunwari*	Beautiful foliage & has motile sperms. A living fossil.	A native of China ; Propagated by seed.

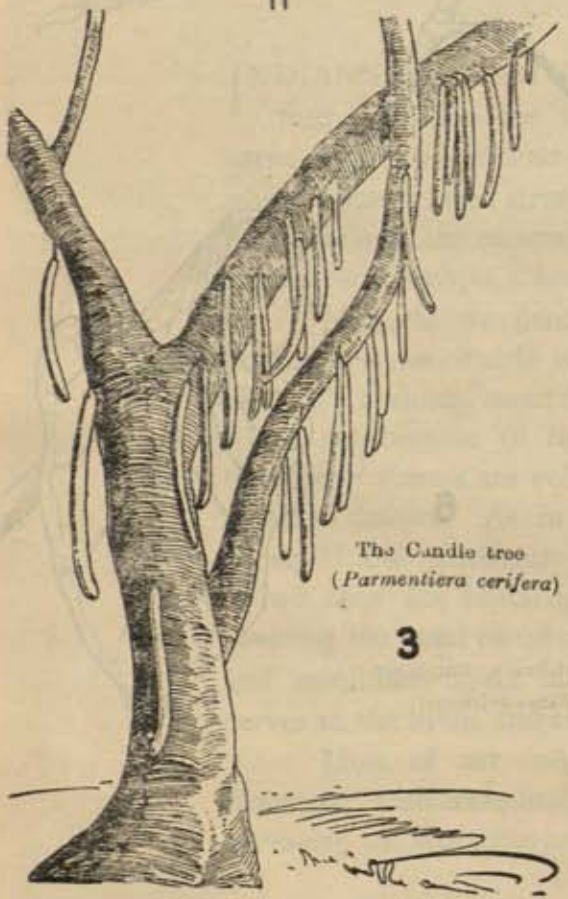
SOME ODD AND UNUSUAL TREES

1

A branch of Maidenhair tree
(*Ginkgo biloba*)

2

The Cannon ball tree
(*Couropita guiannesis*)



The Candle tree
(*Parmentiera cerifera*)

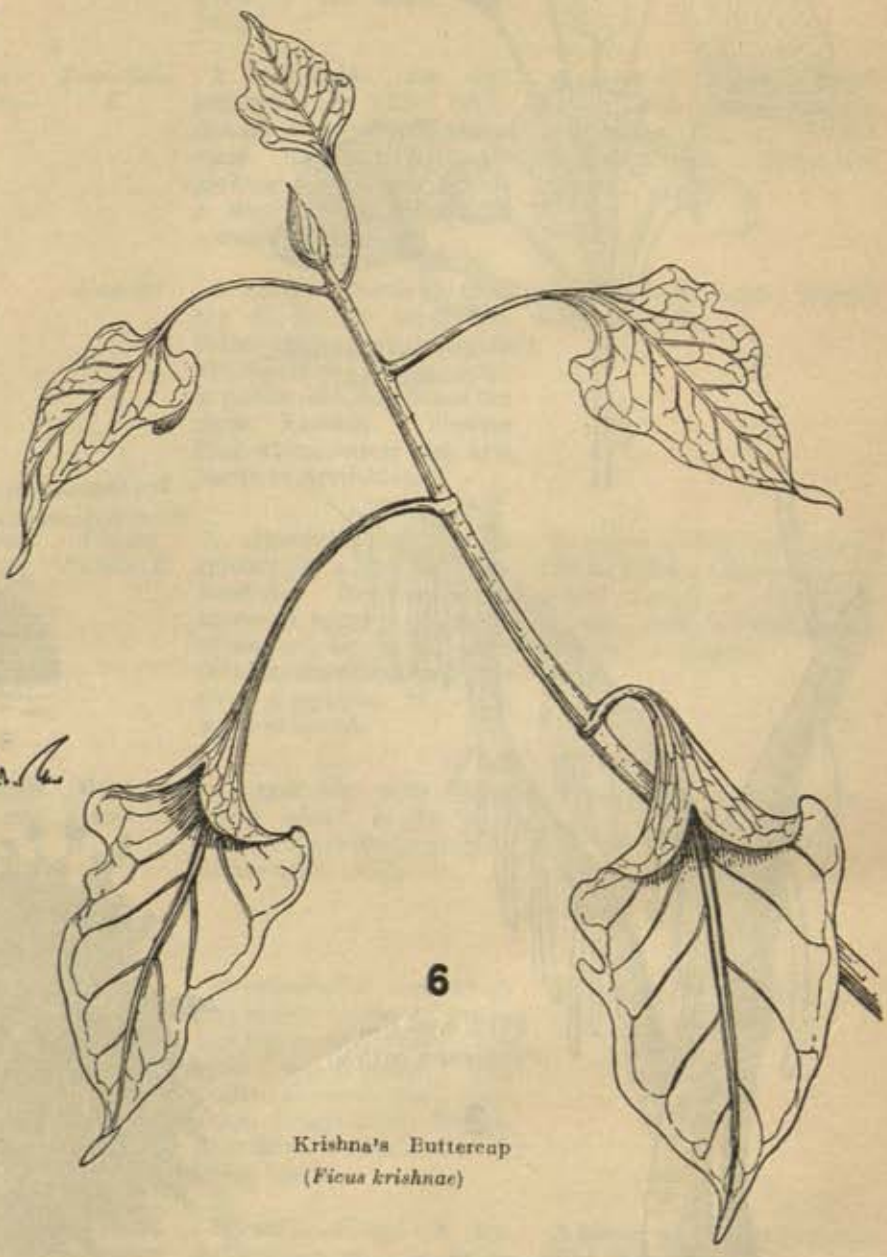
3

4

The Sausage tree
(*Kigelia pinnata*)

5

The Traveller's tree
(*Ravenala madagascariensis*)



6

Krishna's Buttercup
(*Ficus krishnae*)

CHAPTER 28

Fragrant Shrubs and Trees

INDIANS appreciate fragrant flowers more than Westerners. In fact, in their adoration for fragrant flowers our ancestors had gone to such an extreme that they had no place in their gardens for flowers without scent. Scents which appear too strong to Europeans appeal to us highly and no garden, particularly in the compound of a house is regarded complete without fragrant shrubs like *Champa*, *Chameli* and *Raat-ki-Rani*.

How do we perceive the fragrance of flowers ? The sense of smell, unlike the sense of sight where the stimulating agent is a physical influence like light, is a chemical sense in which the stimulating agents are chemical substances which act because of their molecular structure. These chemical substances in the case of flowers are volatile oils which are stored in glandular cavities in the petals of flowers. As in the case of the sense of taste, so in the case of the sense of smell the particular chemical substances have to be dissolved in water before they are effective. The odorous substance dissolves in the moisture covering the nasal membrane. The ciliated epithelial cells of the nasal membrane and scroll-like layers of the turbinal cavities dispatch impulses through sensory nerves to the brain, and one experiences a sensation of smell.

Most of our fragrant trees and shrubs belong to the families Oleaceae, Rosaceae, Rubiaceae and Rutaceae. Some of these plants particularly those belonging to Rosaceae and Rutaceae are not merely ornamental and are also

our favourite fruit trees. Apples, pears, peaches and cherries as well as citrus plants combine beauty with utility. So far as fragrant trees and shrubs are concerned, there is no reason why fragrance of flowers should not be combined with utility of fruit. The Moghuls planted limes and oranges in their gardens to enjoy their fruit and the fragrance of their sweet-scented flowers in the months of February and March.

Due to the pioneer efforts of S. Lal Singh, a large variety of citrus plants are available which can be grown in the back part of the compounds of houses. Oranges, like blood-red Maltas, *Santras*, Mosambi, Pomelo, the red-fleshed *Chikotra*, *Khatta Nimboo*, Sweet Lime and Grape-fruit not only provide health-giving fruit rich in vitamin C, but their flowers also fill the air with delicate fragrance in the months of March and April. Hazara orange or *Narangi Bara-Masi* appears very attractive when grown in standard form in wooden tubs and is a desirable plant for decoration of verandahs, particularly in big buildings.

Fragrant hedges

For internal hedges whose sole function is to mask unsightly features like garages, and kitchen garden or separation of the rose garden from the rest of the garden, we can make use of fragrant shrubs and dwarf trees. Hedges of shrubs like *Bela*, *Raat-ki-Rani* (*Cestrum nocturnum*), *Papra* (*Gardenia latifolia*) and *Laung Mushk* fill the air with delightful fragrance and in hot and rainy months they are very desirable. I cannot forget a joyful evening in a bungalow at Dewaldhar in Almora district in the month of May where the white flowers of *Laung Mushk* were studded all over a dwarf hedge. At sunset the verandah was filled with the delicate scent of this species of Gardenia and coupled with the warmth of the air it induced a feeling of relaxation and happiness which the legendary Lotus-eaters might well envy. *Champa* and *Laung Mushk* are great favourites with the people of Kangra Valley, and in gardens in Dharamsala and Palampur, air is filled with the heavy scent of these flowers at night time. With the background of snow-covered Dhaula Dhar which glistens like a lump of silver in the full moon, and the gurgling sound of numerous streams and rivulets, Kangra Valley appears like a fairy land. Perhaps it was an evening in this part of India, described by Sarojani Naidu :

Where the golden, glowing
Champak-buds are blowing,
By the swiftly-flowing streams,
Now, when day is dying,
There are fairies flying
Scattering a cloud of dreams.

Some of the dwarf trees like *Acacia farnesiana*, *Murraya exotica*, *Gardenia lucida*, *Franciscea hopeana*, *Ixora parviflora*, and *Lawsonia alba*,

The Pagoda tree bears large corymbs of fragrant white flowers.

can also be utilized for making fragrant hedges. However, to keep them in check some of these require severe pruning.

Madhavi lata (*Hiptage madablota*) was a favourite creeper of the ancient Hindus. In Hindu flower symbolism, the *Madhavi* creeper is likened to a frail young woman clinging for support on her lord and master, symbolized by the mango tree. Marriage of the *Madhavi* creeper and mango t ree was performed by ancient Hindu hermits. Thus says Kanva, the hermit, to Shakuntala after she had met her lover Dushyanta.

My child, you found the lover who
Had long been sought by me ;
I'll give the *Madhavi* creeper a lover true
This handsome Mango-tree.

Mehndee (*Lawsonia alba*) has an important function in toilet of women in the East. Women stain the palms of their hands, soles of their feet as well as their nails with crushed *Mehndee* leaves. It is also used for dyeing hair, and flame-coloured beards of Mullahs owe their rich coppery tints to *Mehndee*. *Mehndee* is the Camphire of Palestine, Hennah of Iran and Pliny called it the Cypress of Egypt. It is commonly grown in India, Afghanistan and Iran, and is valued as much for the red dye in its leaves, as for the delicate fragrance which its flowers exhale in evening time in the months of June and July.

A *Har Singhar* tree planted in the eastern part of the compound of a house opposite a verandah used for sleeping can be a source of great pleasure during the months of September and October. After dark the fragrance of the night opening flowers of *Har Singhar* fills the atmosphere. A small cemented pool may be constructed below the tree for collecting flowers. Every morning in the autumn months you will see myriads of flowers with their orange-coloured corolla tubes resting on the surface of water on their spoke-like snow-white petals.

Champak tree was very popular with the ancient Hindus and we find it sculptured in Kushan Mathura about 2,000 years ago. Even now Champak flowers are used by the women of Bengal in their coiffure, and the delicate fragrance of their amber petals adds to their subtle charm.

Planting a hedge

Make a sufficiently deep trench, 2 to 3 feet in depth, on the site of the hedge. A shallow trench inhibits growth of deep roots, while a deep trench induces perpendicular deep root action. Place a layer of decomposed farmyard manure at the bottom of the trench, and refill it. Irrigate the trench, and when the soil has settled, sow the seed or cuttings in 3 to 4 lines. Seed may be soaked 6 to 24 hours before sowing to hasten germination. The trench should be kept moist till the seeds germinate or the cuttings sprout. A thin top dressing of charcoal ash, compost and sand helps in retention of moisture.

Occasional hoeing with a *khurpa* encourages growth of hedge plants ; and should be followed by application of compost. Soft-wooded hedges can be pruned at any time, but hard-wooded species should be pruned when the season's wood has matured. When the plants have matured their wood, watering should be partially suspended. According to Griessen over-watering of hedge plants induces shallow-root action.

Colourful flowering hedges

Apart from the fragrant flowering plants already mentioned, the following flowering trees and shrubs may also be used for making colourful hedges.

1.	*Erythrina indica Lam.*	...	Scarlet
2.	*Hibiscus—all varieties*	....	Shades of red
3.	*Plumbago capensis Thumb.*	...	Blue
4.	*Meyenia erecta Benth.*	....	Blue
5.	*Strobilanthes*	....	Blue
6.	*Bauhinia acuminata Linn.*	....	White
7.	*Bougainvillaea*	...	Shades of magenta, orange and red.
8.	*Sesbania aegyptiaca Pers.*	....	Light yellow and salmon pink
9.	*Tecoma stans H. B. K.*	...	Yellow and chocolate

Shrubs and trees with fragrant flowers

Serial No.	Natural order.	Botanical name.	Common Indian and English name.	Description.	Gardening notes.
I	Annonaceae	*Artabotrys odoratissimus*	*Hari Champa*	A large scandent shrub, leaves broad, lanceolate, glossy; inconspicuous green flowers, usually hidden in leaves emitting delicate perfume, like those of over-ripe apples. Flowers in July and August.	Propagated by seed or cuttings in rains.
II	Apocynaceae	*Tabernaemontana coronaria.*	*Chandni* or Moonbeam	A shrub 4 to 6 ft. high with broad shining leaves and large double, dazzling white flowers which appear very pretty in moon-lit nights in rainy months. Only slightly fragrant.	To improve the size of flowers thin off the leaves when flower-buds begin to form at the ends of branches. Propagated by layers or cuttings.

Serial No.	Natural order.	Botanical name.	Common Indian and English name.	Description.	Gardening notes.
		Carissa carandas	*Karonda*	A small scandent thorny shrub with ovate dark shining leaves, bears highly fragrant flowers in February and white pink and scarlet berries in July-August. Buds open in the evening and emit a delicious fragrance.	Propagated from seed in rains. Excellent for hedges.
III	Magnoliaceae	*Magnolia grandiflora*	*Bara Champa*	A small tree 10 to 15 ft. high, laurel-like leaves; big white fragrant flowers in April and May.	Propagated by *gootee* but with difficulty.
		Michelia champaca	*Champa* or *Champak*	A small handsome evergreen tree, 15 to 20 ft. high, fine foliage, flowers emit a delicious fragrance in April. Flowers yellow, solitary in axils of leaves.	Propagated from seed.
IV	Malpighiaceae	*Hiptage madablota*	*Madhavilata*	A rampant shrub with horse-chestnut-like fragrant flowers in March.	Propagated from seed.
V	Oleaceae	*Jasminum sambac*	Jasmine, *Mugra*		Propagated by cuttings or division of roots.
		Nyctanthes arbortristis	*Har Singhar*	A tree about 10 ft. high, bears a profusion of star-like, white flowers with orange centre at night time which are shed in early morning. Flowers in September-October. A common tree in Oudh.	Propagated by seed sown in rains. Plants should be renewed every third year. It is quick growing and, its long woody shoots should be pruned after flowering
VI	Rubiaceae	*Gardenia florida*	Cape Jasmine *Gandha Raj*	A delightful shrub, with glossy obovate leaves; bears large double white fragrant flowers in March and April. A native of China. A large-flowered variety with leaves 4 in. diameter is available.	Grows to a height of 6-8 ft. Propagated by cuttings in rains.
		G. lucida		A small tree 8 to 10 ft. high; bears solitary fragrant white flowers in April and in July.	Propagated in rains by cuttings. Can be kept in a dwarf condition by pruning.
		G. latifolia	*Papra*	A small tree with leaves 15 in. long 6 in. wide; large fragrant white flowers in April. Flowers turn yellow in the evening.	Propagated in rain by cuttings.
		Ixora parviflora	*Rookminee*	A shrub 6 to 8 ft. high, with handsome lanceolate leaves 3" to 8" long; large corymbs of white fragrant flowers in April-May. A very beautiful plant, is a native of China.	Propagated by layers or cuttings.

Serial No.	Natural order.	Botanical name.	Common Indian and English name.	Description.	Gardening notes.
		Anthocephalus indicus	*Kadamb*	Ovate-oblong glossy leaves, golden-yellow flowers solitary at the end of branchlets. Associated with Krishna. Flowers in great profusion in August.	Propagated by seed in rains.
VII	Sapotaceae	*Mimusops elengi*	*Maulsari* or *Vakula*	A beautiful tree with a thick spreading crown, dark-green glossy leaves ; pale-green fragrant flowers in March. A very nice shade tree.	Propagated by cuttings in rains.
VIII	Rutaceae	*Murraya exotica*	Chinese Box *Kamni*	An evergreen shrub, globular crown ; sweet-scented pure white flowers.	Propagated by seed in rains.
		Citrus aurantium	*Khatta*	A spring shrub useful for a protective hedge.	Propagated by seed in rains.
IX	Solanaceae	*Cestrum nocturnum*	Lady of the Night, night blooming Jasmine *Raat-ki-Rani*	A shrub with pale-green inconspicuous flowers which emit a strong fragrance at night.	Propagated by cuttings in rains.

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