CHAPTER IX

SUMMARY AND CONCLUSIONS
For the purpose of the present study, eight forest sites (Bandri, Shahgarh, Obbohand, Jamghat, Neemghatia, Rahatgarh, Jaruakhara and Patharia) of dry deciduous forests of Sagar within a radius of 75 km, have been selected around Sagar town (23°50'N latitude and 78°40'E longitude). Forests are heterogenous in their vegetational composition, density and extent due to extreme biotic interferences. Most dominant tree species at all sites are Diospyros melanoxyylon, Tectona grandis and Lagerstroemia parviflora.

Almost all forest sites are dissimilar in their vegetational composition except Shahgarh and Bandri, which are most similar not only in vegetation but also in soil, topography and geology.

*D. melanoxyylon* is widely distributed throughout Madhya Pradesh state except the drier parts like Bhind, Datia, Guna and Gwalior, where it is scanty. In Sagar district it is abundant throughout except Obbohand and Ramna forest stands.

Overall average absolute density of saplings, coppices, and trees of all species/ha is found to be 443, 1050 and 1205 respectively as against the average relative density values 261 (saplings), 412 (coppices) and 409 (trees) of *D. melanoxyylon*. Average basal area of *D. melanoxyylon* is
found to be 2.967 sq m/ha along with its highest frequency value (98%) at Jamghat site. It indicates its best phytosociological performances at Jaruakhera and Jamghat forest sites. Common associates of *D. melanoxylon* amongst all forest sites are *Acacia leucophloea*, *Buchanania lanzan*, *Elaeodendron glaucum*, *Flacourtia indica*, *Gardenia latifolia*, *Lagerstroemia parviflora*, *Lannea coromandelica*, *Tectona grandis*, *Terminalia tomentosa* and *Zizyphus xylonurus*.

Leaves of *D. melanoxylon* (tendu leaves) contribute a large fraction of revenue to different states. Prior to the nationalisation (28 November, 1964), average annual revenue from 'tendu' leaves in Madhya Pradesh was merely 86 lakh rupees, which after nationalisation has crossed the limit of rupees 22 crores (about 60% of India's total revenue). In Sagar, Kesli, Goujhamar, Deori, and Rehli forest ranges contribute maximum towards tendu leaf collection and on an average, 69707 standard bags (worth rupees 41.58 lakhs) are produced annually in the district. However, the quality is much inferior in comparison to Shahdol, Raipur, Bilaspur and Bastar district of the state. Leaves of various trees have been used in different parts of the country as 'bidi' wrapper but 'tendu' leaves are found to be the best, as they show easy workability when dried, pliable, palatable when smoked, resistant to early decay, have suitable size, leathery texture and availability
in bulk. Normally women and children contribute maximum labour towards leaf plucking and collection, which is completed from mid April to the first week of June, every year.

Morphological features of *D. melanoxyylon* have been described in detail. It is observed that almost all the phenological events of this species are completed in summer season. These events have been recorded earlier on plateaux, and rocky areas of open forests. Leaf fall and leaf emergence are overlapping, hence naked trees of *D. melanoxyylon* are never found in forests. It indicates towards its evergreen tendency. Production of fruits is maximum at Jamghat site, mostly in trees having 6 - 20 cm height and 20 - 60 cm diameter at breast height.

*D. melanoxyylon* and its allied species (*D. tomentosa* and *D. tupru*) which are described in floras show no clear cut differences in morphology. These species are considered as single species - *D. melanoxyylon* by some authors. However there are considerable morphological variations in the form, colour and texture of leaves, phyllotaxy and phenological events within *D. melanoxyylon* itself. Male and female plants also show differences in morphology, even in the vegetative phases of the plants. Reporting of monoecious tree during the present study indicates that
various grades of separated sexes are present in the species. Emergence of new leaf buds branches is maximum from February to July, however red leaves on plants are found maximum in March.

Insect damage to 'tendu' leaves by bores and galls is maximum during summer, specially when the new foliage comes out. The gall forming insects are found to be more on the lower surface of the leaves than on the upper.

Natural regeneration in *D. melanoxyylon* is seen mostly by root suckers and sometimes by seeds. Sucker generated plants are more on slopes of open areas or biotically disturbed forests in comparison to plateaux and bases of thick forests. Amongst all sites, 'Regeneration Index' of *D. melanoxyylon* is found maximum at Rabatgazh and Patharia sites. Considering all tree species, *D. melanoxyylon* and *Butea monosperma* show higher regeneration index values.

In *D. melanoxyylon*, two types of root systems i.e. of sucker-generated and seed-generated plants have been found. Majority of plants show sucker-generated types of root system. Similarly male and female plants also indicate their separate root systems in different topographic situations. Maximum sprouting of root suckers is found in June. Beside *D. melanoxyylon* root suckers are
also seen in *Dalbergia sissoo, D. latifolia, Salmalia malabarica, Stereospermum suaveolens, Azadirachta indica* and *Ougenia coenenensis*. Dying back phenomenon is also very common in *D. melanoxylon*, specially in male plants.

Silvicultural responses of *D. melanoxylon* towards regeneration and leaf quality have been studied and the results are found as under:

(i) Pruning of 'tendu' bushes from December to May is most suitable to increase size, quality and yield of leaves. Emergence of new leaves after pruning is faster in summer than winter.

(ii) Out of various leaf plucking grades, G III and G IV are found to be most suitable, because they give large number of quality leaves and comparatively lesser insect damage from other plucking grades.

(iii) Pollarding of tendu trees is satisfactory from December to March to obtain leaves of good quality and size.

(iv) *D. melanoxylon* coppices strongly and its sucker generated populations give good quality leaves of larger size. Felling of trees with axe produces more coppices than by saw, particularly in the period from January to April.
(v) Felling of trees of *D. melanoxylon* in winter gives maximum number of new branches, quality leaves and there is not much insect damage to new leaf crop. Trees having diameter from 4 to 20 cm if felled up to ground level give maximum sprouting than those felled at some height from ground level.

(vi) Fire in early summer stimulates production of leaves of good quality, more bud initiation, and minimum insect damage to leaves.

(vii) Eighty percent of vegetatively propagated root sucker pieces, sprouted and continued to survive for about eight months.

**Important findings**

*Diospyros melanoxylon* forms separate male and female populations of its own, however monoecious trees are also found though rarely.

Natural regeneration by root suckers is more frequent than by seeds. Each tree i.e. male, female sucker generated and seed-generated has got its own root system.

Seedlings of *D. melanoxylon* show dying back phenomenon which is more frequent in male than in the female plant populations.
Overlapping of leaf fall and leaf emergence indicates its evergreen tendency.

Its light demanding nature provides abundant growth in open and biotically disturbed forests.

Biotic interferences like felling of trees, pruning, pollarding, coppicing, leaf plucking and soil excavations etc. favour production of quality leaves and regeneration.

The plant checks soil erosion by binding soil through underground network of root suckers.