

# TREE MALADIES & REMEDIES IN CHANDIGARH

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Published by :

**DEPARTMENT OF FORESTS & WILDLIFE, CHANDIGARH ADMINISTRATION**





**AN UNUSUAL APPEARANCE OF RED COTTON BUG IN THE CITY**





**DEBARKING LEADS TO TREE DECLINE**





LEMON BUTTERFLY CATERPILLAR-A VORACIOUS FEEDER



**DEPARTMENT OF FORESTS & WILDLIFE, CHANDIGARH ADMINISTRATION**

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**Santosh Kumar, IFS**



**Conservator of Forest, Chief Wildlife Warden,  
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**Message**

**4<sup>th</sup> of June, 2015**

The climate of Chandigarh is so blessed that many of the exotic species are also established here like other indigenous species. With the development of the city over the years however, there was removal of the trees and also decline in the health of some of the tree species due to various biotic and abiotic factors. Of late it has been observed that the tri-city flora is being affected by one or the other malady that is eating into the city greens. There is infestation by some serious kind of insects like white ants, mealy bug and the tree borers leading to the gradual tree decline; there are other apparent reasons too. It has been observed that over a period of time some of the pests are attaining the stage of epidemic form. It was due to these reasons that the present study was undertaken to 'Identify and enlist the Chandigarh flora with respect to the sensitivity of various tree species to recently reported tree maladies and suggesting ways and means to check tree damage'.

I am happy to note that the above study was awarded to Principal Investigator - Dr. Satish Narula, Former Senior Extension Specialist (Punjab Agricultural University), Incharge FASS, UT Chandigarh by Forest department UT Chandigarh after getting it funded through Science & Technology Department, UT Chandigarh.

I extend my sincere congratulations for publication of "Tree Maladies and Remedies in Chandigarh". I am sure that this document will not only throw light on the possible cause of tree decline and remedies in Chandigarh but will act as guidance for other cities of the country where such tree maladies are observed.

A handwritten signature in black ink, appearing to be 'Santosh Kumar'.

**(Santosh Kumar)**





**Dr. Satish Narula**

**Former Senior Extension Specialist  
(Punjab Agricultural University),  
Incharge FASS, UT Chandigarh**

### **Preface**

**4<sup>th</sup> of June, 2015**

The residents of Chandigarh feel pride in living in one of the greenest cities of Asia. Their love for the flora is visible as they want to have all kind of plants in the confines of their home gardens. The development departments are also doing their bit to give aesthetic look to the city. This is also evident from the upkeep of city gardens and greens.

The city got its green cover from none other than Dr. M.S. Randhawa who the Chairman of the first Landscape Advisory Committee. At that time almost all kind of tree species whether indigenous or exotic were introduced in the city from various parts of the country. This was done in addition to the preservation of local flora which still exists in the form of groves. All thanks to the prevailing climatic conditions, most of the flora settled here making this city its abode. Some of the exotic species even allowed multiplication by propagation through seeds or vegetative means. However, over a period of time these were exposed to the local plant problems created partially by the human error or the climatic or other natural causes. There started decline of some of the species. Also there started appearing some new insects and diseases. This led to the slow decline of dying of the plants.

Need was felt to study the underlying causes of tree decline. The Department of Forests of the Chandigarh Administration responded to the call and constituted a study. The work was assigned to the author the subject Matter Specialist Horticulture from Punjab Agriculture University based in Chandigarh. The experience of being a part of the city for more than three decades came handy and the work was started on various aspects working on both biotic and abiotic factors responsible for the gradual tree decline. During the course of study many a new interesting facts came into the notice of the investigator. Some of the new insect, pests and diseases were observed. Also there was unexpectedly seen a definite shift of some of the pests and diseases to unknown alternate hosts that need further study. The document thus made holds good for all the cities of India as the problems are common.

I wish to thank Mr. Santosh Kumar, IFS Conservator of Forests, Department of Forests & Wildlife and Director (Science & Technology) Chandigarh Administration for showing faith in me for carrying out this study. During this study the author was assisted by a Research fellow, Nitu Adiwala, M.Sc., Floriculture, without whose sustained help this study would not have been possible. I wish this study comes handy for all those responsible for the green development of the city to make it a 'Model Horticulture City'.

**(Dr. Satish Narula)**



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## Tree Maladies and Remedies in Chandigarh

### Introduction

Chandigarh the city beautiful is known the world over for its planning and the green cover. It is known to be the greenest city in Asia with 38-04 percent area under green cover. The city was planned by Le Corbusier and it was provided with the green apparel by Dr. M S Randhawa, who was the Chairman of the Chandigarh Landscape Advisory Committee (Archives). He introduced many indigenous as well as exotic species in Chandigarh. He also had passed strict instructions to preserve the old plantation comprising of the seedling mangoes and other indigenous trees.

To understand the greenery in any city, it is important to understand its climate. The City receives 1110.7 mm average annual rainfall, 80 percent of which is received during monsoon period i.e. June-September. July and August are the rainiest months. Ten percent of the normal rainfall is received in cold season. On an average, there are 49 rainy days (days with rainfall of 2.5 mm or more) in a year. The heaviest rainfall in 24 hours recorded in the union territory was 262 mm on 18th of July, 2000 (Tribune, Sept 13, 2002).

At the time of original planting, a large number of indigenous and exotic species were introduced both in avenue plantation, in parks and also in scattered manner in the city. Over a period of time, some of these species have established and have made this region their abode. However, trees like Gulmohar (*Delonix regia*) and most of the *Cassia spp.* have almost disappeared due either to short life span or brittle branches that snapped with wind. In such cases, repeated breaking gave rise to cluster of weak branches. Such trees were also severely infested with insects due to the irregular breaking of limbs. A few specimens could still be seen struggling for life on Madhya Marg.

The health and life of the tree depends upon its root system which also provides anchorage to the tree. However, the tree root system in cities is exposed to repeated assaults by service providers that comprise agencies operating in road, sewerage, water, communication or electricity. It is because of this reason that the life of the tree is tremendously cut-short. As the roots are repeatedly damaged severely, there is no scope of survival or taking corrective measures. Trees are the integral part of landscape, however, the nature of different tree species is one aspect that was least studied and understood. The plantation in olden times was mostly on the basis of whatever-is-available in the nursery or at the most due to the shape of the tree and it was not location specific. Not much work was done on the nature of trees used in the cities for avenue and garden plantations.

In Chandigarh, as the city came up and developed, various tree species were planted and some



of even exotic species gave good performance. However, now when the trees are fully grown, their usage, merits and demerits on the city roads are visible. For example, in case of Arjun tree (*Terminallia arjuna*) that forms two prominent avenues across the length and breadth of the city, have more of disadvantage than doing the good. They bear bold but light seed capsules during summer when the monsoon is round the corner. As the rain starts accompanied by winds, all the seed capsules fall to the ground, are carried with run-off water and choke the sewerage causing pool of water. As the tree is very prone to borer attack, its limbs have become hollow within and snap with a wind velocity even a little more than the normal. And above all, the ignorant and greedy people remove the bark and leaves to use these plant parts for medicinal purpose with no consideration for tree life and also knowing not that whatever they were eating was nothing but pollution laden poison.

Similarly, the planting of the trees like Pilkhan (*Ficus benghalensis*) as avenue tree was not a good choice as the Pilkhan and for that matter any other *Ficus* species plant attains huge dimensions above ground and need matching anchorage. However, practically it is not possible as the roots have hardly any space to spread with the result that they do not get the matching nourishment. There is a loose



**Picture 1: Poor anchorage, a matter of days before the tree falls**

anchorage too due to the damage caused by digging by various departments. Another disadvantage is the crushing of the dropping seed capsules under the vehicles making the road slippery posing danger for the commuters, especially when the fall due to high winds is followed by drizzle.

The silver oak is another tree that is too prone to white ant and mango mealy bug attack. The



infestation causes gumming and there is tree decline. There are other tree species too that will be dealt with in detail. When we study the causes of tree decline, both the biotic and abiotic factors contribute towards various maladies.

### **Aims and Objectives**

The Chandigarh climate is so blessed that many of the exotic species also established here like other indigenous species. With the development of the city over the years, however, there was removal of the trees and also decline in the health of some of the tree species due to various biotic and abiotic factors. Of late, it has been observed that the tri-city flora is being affected by one or the other malady that is eating into the city greens. There is infestation by some serious kind of insects like white ants, mealy bug and the tree borers leading to the gradual tree decline. There are other apparent reasons too. It has been observed that over a period of time some of the pests are attaining the stage of epidemic form. It was due to these reasons that the present study was undertaken to 'Identify and enlist the Chandigarh flora with respect to the sensitivity of various tree species to recently reported tree maladies and suggesting ways and means to check tree damage'. It is felt that this document will not only throw light on the possible causes of tree decline and remedies in Chandigarh only but will be a guideline for other cities of the country where such urban planting has been done.

### **Methodology adapted**

All the city avenues were marked for different kind of species. Individual tree species were studied for their growing nature, merits and demerits, sensitivity to insect-pests and diseases, present state and appearance of different pests on it, sensitivity to pollution, appearance of new insects and diseases. For this, tenth tree of almost every species was visited for visual observations and present status. Similarly, various parks and gardens were surveyed to study the condition of trees and shrubs. Wherever new disease or insect symptoms or specimens were found, these were collected and got identified from the institutes like PAU, Ludhiana, IARI PUSA or FRI, Dehradun. Based on this, certain conclusions were drawn. Identification of certain pests needs further study and explanation.

### **Manmade factors responsible for tree damage and decline**

While dealing with plants, one can understand the damages caused by the natural calamities but it is disappointing to see that in cities, the well-established, known and recommended practices are not followed. Lot of damage could be avoided if only the decision making with respect to cutting of limbs, making pits near the trees etc. is done after consultation with experts with technical knowledge of horticulture. Presently, it is being done by those who have least understanding of the subject causing tremendous damage to the city flora.

To understand this problem, one should know that the spread of roots is normally as much as



the drip area or the canopy of the tree. This aspect is least understood and it is because of this reason that the people dealing with the development work are unaware of the damage that they inflict by faulty planning and execution of work; be it the digging of the trenches, expansion of the roads or laying the paver blocks, concretization of the areas around trees besides other operations. This could be avoided only when there is co-ordination and understanding between various development departments with that of the horticulture department.

#### **Making or Unplanned extension of roads**

There is no doubt that for the development works in the cities, at times, trees have to be removed but many of them could be saved even when a least consideration was shown to save them. It has been observed that at many places the trees are removed when even a slight shift in alignment could save them. It was also observed that even where there was plenty of space to shift the cycle track; it was constructed very near to the feet of the trees severely damaging the roots as has been done in sector 18 near the Sector 18-19 traffic lights. The dead and cut roots become breeding ground for the insects and pests and such trees were subjected to the potential danger of falling during the monsoon or due to high wind.



**Picture 2: Realignment could have saved the tree which stands as a danger**



One of the reasons of the deteriorating health of the trees in the city is poor anchorage, damage to the roots and piling of the mud etc around the trees. It is due to the unending task of making trenches along the road and then piling up the mud and malba with the excavated soil. The piled up mud also conserves moisture and it becomes potential danger for the bark and the phloem in the immediate vicinity. It becomes a perfect breeding place for the insect/pest and diseases. There is also no provision left to provide plant protection by using chemicals that need to be applied in the root zone.

### **Creation of pavements**

Creation of pavements makes the soil compact that resulted in low availability of water and air to the plant roots. Also, as the blocks are impervious, there is no seepage to sustain the water requirement of the trees and there is almost hundred per cent run off and wastage of rain water. It has also been reported that the hard surface results in the increased amount of pollens in the atmosphere as those falling on the hard surface are subject to be air-borne again. This caused increased amount of allergens in the air

The hard pavement surface absorbs tremendous heat during summer months and thin surface roots of the trees that are the true feeders get burnt causing severe setback. Besides, lot of damage is caused to the feeder roots while laying out the pavement blocks. It is because of these reasons that the tree roots are subjected to fungal infestation. The cut and dead roots also act as pathogen pool in soil for furthering infection. A tree with damaged roots loses its anchorage and falls to support the above-ground heavy head that results in its falling during storm conditions.



**Picture 3: Hardly any root is left under the paver blocks.**



### Use of crude equipment for removing limbs

The first mistake is made when the selection of tree species is made without taking into consideration the overhead wires. And when there is conflict of the tree limbs and branches with overhead wires, the concerned department workers cut them with 'weapons' like crude blade (*gandasa*) and axe causing tremendous damage to the trees. They are also not aware about the correct process of cutting big limbs with the result that while cutting, the heavy branches in the process of being cut fall midway, dragging and damaging most of the tree bark and also other tree limbs and branches. The uneven cuts inflicted on the limbs and branches become the breeding ground for insect, pest and diseases that invade through such exposed surfaces. The most serious of all is the tree borer (*Indarbela* spp.). It enters the damaged limbs through the irregularly cut surface and makes its abode in the heart of the tree. The damage to the tree by this insect is multifarious. It makes holes in the tree damaging the conduction channel interrupting the nutritional movement. Due to this, the root system is also weakened. The borer also eats bark of the tree and damages the tissues below, again causing damage to the conduction channels. It secretes certain chemicals too inside the tree that burn the heart of the tree further damaging the conduction channels.

The tree limbs become hollow from within and fall off with the slightest of wind velocity that is even a little more than the normal. This aspect was especially dealt with during this study. All the city avenues comprising of various tree spp., were marked and every 10<sup>th</sup> tree was visited to see the extent of damage caused by the borer. It was observed that the damage of this insect was more pronounced in case of Arjun, Amaltas, Silver Oak and *Chorisia speciosa* etceteras. In the home gardens too, this insect thrives on various fruit trees like guava, litchi, citrus spp., pear, sapota and mango.

There is a need for giving strong instructions against the use of such equipment to the concerned departments. For this purpose only electrical/mechanical saw should be used. One third cut should be given from below and the cut given from above should meet this cut in the mid-way. Such a cut with smooth round surface does not allow the entry of insects like the tree borer. Another way is to cut the limbs few feet above the intended length with axe etc. and then giving a regular cut with a saw. For any such operations of cutting and removing of limbs, the concerned departments should not venture out on their own and should carry out such operations in collaborations with the representative of the horticulture department who are trained to cut such heavy limbs without causing damage to the tree.

### Unplanned planting

While planting various tree species, we see only the size of the plant at the time of planting and forget its potential spread and height in years to come with the result that after a few years, it starts interfering with overhead lines causing repeated electricity supply failure. Such trees are subjected to repeated cuttings and in this process they not only lose shape but are also prone to falling due to lop-sided growth. It is, therefore, necessary to see the space available and then select a suitable species for planting. The planting agency should also be aware about the under ground facilities.





**Picture 4: Conflict between tree and over head lines**

Another glaring example of the unplanned planting is that of *Tecoma argentea* planted close to the edge of the road along the Jan Marg and which has dangerously bent on the road causing potential threat to the life and property of the pedestrians as well as road users. These plants were planted unmindful of the Chukrasia (*Chukrasia tabularis*) growing in the very near vicinity. It is for the want of the space and light that *Tecoma argentea* is unable to grow straight up naturally and is bending towards the road.



**Picture 5: Dangerously bent Eucalyptus tree on Madhya Marg**



**Picture 6: Dangerously bent Tecoma argentea trees on Jan Marg**



It had also been a practice to do the gap filling in various tree avenues with whatever species was available in the nursery. This trend of planting off type plants in an avenue has spelt trouble for the existing plants as the insect and disease that were specific to that species have started spreading to the other plant species in the near vicinity making these their alternate host. The planting at *Madhya Marg* is such a mixed type of planting that comprises mostly of plants of *Cassia spp.*, *Haldu*, *Kusum*, *Chukrasia*, Silver Oak, *Koelreuteria*, *Ficus spp.* trees and many more. No consideration was given to the selection of specie at the time of subsequent replacement that should have been the same as the dead tree.

Over a period of time due to brittleness of branches there has been tremendous breaking of limbs and branch snapping especially in various *Cassia spp.* plants that have put forth multiple stems at the broken ends. These are weak by nature and break easily during rains and high wind velocity. It has also been observed that in most of the avenue planting, the trees have limbs spreading towards roads interfering with the smooth movement of the traffic. The departments concerned should periodically prune the side branches that interfere. The tree species that are very sturdy and make high crown are *Chukrasia* (*Chukrasia tabularis*), *Mahagoni* (*Swietenia mahagoni*), *Alstonia* (*Alstonia scholaris*), *Buddha's Coconut* (*Sterculia alata*) etc. The trees like *Arjuna*, *Jamun*, *Mango*, *Miletia*, *Pink Mohar* (*Cassia nodosa*) etc should never be planted as avenue trees for various reasons. The cold and frost did not do good to the *Imli* (*Tamarindus indica*) avenue on *Sukhna path* and there was heavy mortality. About 50-60 per cent of plantation died and was replaced by *Chukrasia*. Some of the surviving *Imli* trees are also showing signs of decline.

#### **Removal of wood from trees by nomads**

During winter, a large chunk of wood is pruned and taken to colonies to be used as fuel. It has also been observed that there is unauthorized removal of wood by nomads mainly during winter season. Such activities are causing tremendous damage to the city flora. The breaking of tree branches and limbs exposes it to various kinds of insects, pests and diseases besides causing loss of green





**Picture 7: Unauthorized cutting and carrying of wood damaging healthy trees**

#### **Removal of tree parts for medicinal use**

The trees with medicinal value like Arjuna, Jamun, mango, etc are extensively damaged by the residents who remove bark, leaves and other plant parts for medicinal purposes which, however, is a mis-conception. Such practice is not only damaging for the trees but also a health hazard for those consuming such plant parts. The trees are standing on the road sides and are laden with lethal pollutants that may cause serious health problems. The trees so damaged are exposed to insect and disease infestation. The removal of bark and damage to the conduction channels make the roots weak too as they do not get the photosynthates required for their nourishment, growth and spread.

#### **Fires (burning leaves) under trees**

It is unfortunate that the sanitation staff, wary of removing the broken twigs and leaves from the base of the tree normally leave or collect it near the base of the tree. This kind of pile provides a perfect breeding place for insects especially white ants. Besides, such piles are also exposed to fire hazards either by a passerby or even by a *safai karamchari* that goes unabated. It also caused tremendous damage to the main tree trunk by damaging the conduction channels





**Picture 8: Damaged bark of Arjun tree for medicinal purpose on Jan marg**



**Picture 9: Collection of debris under the tree, which might be burnt later on**

Such a practice is not only against law but also causes health hazards due to emission of poisonous gases and allergens. This also makes the roads unsafe as there is poor visibility due to smoke.

The polluting atmosphere further damages the tree growth. Strict instructions should be given against burning of leaves and those responsible should be subjected to heavy fine.



**Picture 10: The burning of leaves goes unabated.**



### **Pins used to hold banners**

The big nails used by the private sector to tie up banners should be completely banned as this causes injury to the main trunk. There is gumming from the injured plant parts causing permanent damage. The injury caused to the tree invites horde of fungi some of which like poria may advance by drawing moisture. The fungi are known silent killers. The injured parts are also exposed to the attack by various insects. It should be understood that the trees are not the poles provided for such activities.

### **Tree damage caused by the residents living along the avenues**

Due to space constraints and the development, the plantations in some of the avenues have been done just next to the boundary wall of the residences. The trees in some of the cases are heavy shade trees. When these trees grow, they shade the residences and these are then pruned by the residents on their own without permission making the tree growth lopsided. The damage to such trees is multipronged as the crudely cut limbs are exposed to insect and disease attack that hollow the tree from within. Also the lopsided tree is prone to falling during monsoon or with high winds. The selection of species should be as per the space available.

### **Hooking night light system**

Excessive night lighting is now known to cause damage to some trees. However, effects of supplemental lighting on trees are complex. According to Chaney, W. R. of Purdue University, the one recommending the use of such light systems should be well aware about the tree response with respect to the type of lamps used and the spectrum of radiation emitted that may affect some of the crucial biological processes

Trees are dependent for normal growth and development on quality (wavelength or color), intensity (brightness) and duration of light during a 24 hour period (photoperiod). For the normal growth, the tree has to get all these parameters irrespective of the source whether from the natural or artificial lighting. The warm lights emitted by the red or infra-red range extend the day length and can change flowering patterns and promote uninterrupted growth that could be damaging. During adverse weather conditions, there could be damaging in evergreen trees in which case the growth is otherwise slowed down or temporarily suspended. It is not so when they get light almost all the day through, whether natural or artificially. Continuous lighting should, therefore, be discouraged. The trees subjected to continuous lighting show weak response to stresses. Highly sensitive trees should be avoided in areas where high intensity lighting rich in red and infrared wavelengths is used. Work has been done on this aspect and studies suggest the following:



Light source	Wavelength emitted	Potential effect on trees
Fluorescent	High blue, Low red	Low
Incandescent	High red and infrared	High
Mercury vapor	Violet to blue	Low
Metal halide	Green to orange	Low
High pressure sodium	High in red to infrared	High

**Table 1: Wavelength emitted by different types of light source and their potential effect on photo-biological processes in trees**

#### **Lack of information on maladies and remedies**

The city tree flora can only be saved if it is looked after scientifically. Tremendous damage is caused either due to ignorance or lack of will. The symptoms of various maladies are the repeated appearance of various insects and diseases, the aspect that is over-looked. There is a need for making a calendar of operations for various maladies specific to the tree species that form major part for avenue plantation in the city. There is also need for periodical orientation for the officials concerned with the latest maladies and remedies. Above all, there is need for monitoring the repeated appearance of same problems and the control should be done without complacency, on sustained basis.

#### **Lack of information on damage control after natural calamities**

The plantation is exposed to natural calamities like wind storms, heavy rains and hurricanes. There is tremendous damage to the trees, some of which get completely uprooted. Such like calamities also expose the actual condition of the city flora.



**Picture 11: Scene after natural disaster**



The hanging or broken limbs are snapped with the help of crude equipment like gandasa and axe and are left like that only. Such exposed limbs on trees act as breeding place for insect especially borer and fungal diseases further weakening the trees that are prone to fall and limb breakage, waiting another disaster. After the first clearance of the area such tree should be revisited to give scientific treatment by giving round cut using mechanical saw and smearing the cut area with disinfectants. Such practices, however, are never followed. These like operations hardly take any time provided electrical instruments are pressed for use. It is also very important to do immediate pruning and training of such trees for balancing otherwise there are repeated damages.

### **Pollution**

Much has been said and written about the causes of pollution and measures to check it or at least bring down the pollution level. One of the important measures suggested is the planting of trees that not only act as 'sponge' absorbing gaseous contents but also as a source of emission of oxygen. The information on the pollution resistant species is, however, very less. While planning about the plantation the trees at a particular place in the city the first consideration should be about knowing the pollution areas and then suggesting the suitable species. Even amongst the pollution resistance species, the ones that are indigenous should be preferred for replacement.







2000	-	265	5.7	11	-	424	6.4	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	296	7.0	11	-	460	6.0	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	276	7.0	10	-	401	9.0	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2003	-	212	3.0	27	-	331	4.0	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	111	254	5.0	25	136	364	6.0	34	69	137	6.0	23	-	-	-	-	-	-	-	-	-	-	-
2005	92	215	3	16	147	430	3.0	20	74	186	2.0	13	102	234	2	15	80	198	2	11	11	11	11
2006	87	185	2	12	141	306	2	17	94	191	2.0	10	-	-	-	-	-	-	-	-	-	-	-
2007	88	192	2	16	132	286	2	21	93	197	2.0	13	99	210	2	14	100	216	2	11	11	11	11
2008	81	170	2	15	121	250	2	19	90	182	2.0	13	95	196	2	13	91	191	2	13	13	13	13
2009	77	158	2	17	93	186	2	19	77	155	2.0	12	80	160	2	15	78	156	2	13	13	13	13
Revised permissible limit	60	-	50	60	60	-	50	40	60	-	50	40	-	-	50	40	60	-	50	40	40	40	40
2010	86	-	2	122	122	-	2	20	77	-	8.0	13	-	-	2	12	83	-	2	11	11	11	11
2011	87	-	2	18	137	-	2	20	91	-	2.0	14	90	-	2	14	103	-	2	13	13	13	13

**Table 2: Ambient air quality data in Chandigarh (annual average in microgram per cubic meter )**  
**Source : [www.chandigarhenviis.gov.in](http://www.chandigarhenviis.gov.in); Directorate of Environment U.T. Chandigarh**



### Pollution and tree tolerance

A survey of the polluted areas shows that the prone spp. like *Anthocephalus cadamba*, *Ficus benghalensis*, *F. infectoria*, *Madhuca indica*, *Cassia fistula* etc. were planted in such areas showing poor health. In case of drying of such trees replacement should be done with hardy trees like karanj, siris, alstonia etc as shown in the table.

**Trees are sensitive to both-noise and air pollution. The table below relates to Air Pollution Tolerance (APTC) and Resistance only:**

S.No	Scientific Name	Common Name	Effect of Pollution	Remarks (as said by Different Scientists)
1	<i>Pongamia pinnata</i>	Karanj	Highly tolerant	
2	<i>Albizia lebbek</i>	Siris	Highly tolerant	Can be used to check pollution
3	<i>Alstonia scholaris</i>	Sataparna	High tolerance	Can be used to check automobile pollution
4	<i>Acacia catechu</i>	Khair	High Pollution-resistance	APTI% : 27x2
5	<i>Diospyros montana</i>	Kendu	High resistance to pollution	
6	<i>Emblica officinalis</i>	Amla	High resistance	Useful in checking effects of air pollution
7	<i>Ficus glomerata</i>	Gular	Highly resistant to pollution	APTI %=32
8	<i>Inga dulcis</i>	Jungle jalebi	High resistance	
9	<i>Sapindus mukorossi</i>	Ritha	High resistance	APTI %=32
10	<i>Psidium guajava</i>	Amrood	Moderate to high resistance	
11	<i>Azadirachta indica</i>	Neem	Moderate resistance	Can be used to check pollution
12	<i>Bauhinia variegata</i>	Kachnar	Moderate resistance	
13	<i>Cedrela toona</i>	Tun	Moderately resistant	



14	<i>Ficus religiosa</i>	Pipal	Moderately resistant	Good for checking pollution
15	<i>Moringa oleifera</i>	Sohanjana	Moderate resistance	APTI%= 12x2
16	<i>Prosopis spicigera</i>	Khejri	Moderate resistance	Coal-smoke inhibited pigment concentration, NR activity and sugar content and promoted stomatal index and the nitrate and sulfur contents.
17	<i>Shorea robusta</i>	Sal	Moderately resistant	
18	<i>Ficus benghalensis</i>	Banyan	Moderately pollution resistant	>good dust filtering capacity >effective in checking pollution >carbon monoxide forms a thin layer on the leaves, making it difficult for them to photosynthesis. [the 'mahabodhi tree' in patna is suffering from damage due to pollution]
19	<i>Eucalyptus indica</i>	Safeda	Pollution-resistant to some extent	protective mechanism gets activated in these plants under air pollution stress, and also the plant make physiological adjustments to compensate for that environmental stress.



20	<i>Anthocephalus cadamba</i>	Kadam	Moderate to low resistance	APTI %= 12x2
21	<i>Bombax ceiba</i>	Red Silk Cotton Tree	Moderate to low resistance	APTI %= 10x2
22	<i>Morus alba</i>	Mulberry	Moderate to low pollution – resistance	APTI % : 12x2
23	<i>Aegle marmelos</i>	Bel	Pollution prone low resistance	APTI % :9x2 (=18)
24	<i>Madhuca indica</i>	Mahua	Low resistance	APTI %=9x2
25	<i>Cordia myxa</i>	Lasura	Low resistance	APTI%= 8x2
26	<i>Mangifera indica</i>	Mango	Low resistance	APTI %= 11
27	<i>Artocarpus heterophyllus</i>	Kathal	Low resistance	But can be used to check pollution
28	<i>Anona squamosa</i>	Sitaphal	Low resistance	APTI%= 10
29	<i>Butea frondosa</i>	Dhak, Palas	Very low resistance	APTI %= 5x2
30	<i>Grewia asiatica</i>	Phalsa	Very low resistance	APTI%= 9
31	<i>Dalbergia sisoo</i>	Shisham	Very low resistance	APTI %= 3x2
32	<i>Adina cordifolia</i>	Haldu	Sensitive to pollution	It is specifically sensitive to sulphur dioxide
33	<i>Cassia fistula</i>	Amaltas	Pollution-sensitive	It has less APTI value than control (6.09)
34	<i>Erythrina variegata</i>	Indian Coral Tree	Sensitive to pollution	
35	<i>Saraca indica</i>	Sita Asok	Unknown (different opinions of different people) Low resistance/high resistance to pollution	>Saraca indica 52.0 have very high APTI (air-pollution tolerance index) value over control > Low air pollution tolerance

**Table 3 Air Pollution Tolerance (APTC) and Resistance**



**NOTE: Air pollution tolerance index (APTI) is determined by synthesizing values of four different biochemical parameters: leaf extract pH, ascorbic acid, total chlorophyll and relative water contents (RWC).**

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#### **Dangerous trees/Tree revival**

There are many a factor responsible for damage to the tree that could be attributed to lopsided growth, indiscriminate cutting, poor root anchorage, damage caused for medicinal purposes, burning of leaves, piling up of malba, insect, pest and disease and other such biotic and abiotic factors. Since the affected trees are not being treated scientifically, they have become a potential danger to life and property. They also become a perfect breeding place for insect, pest and diseases. Such trees keep standing by the roadside or outside residences for long time till when they fall under stress. A scientific approach is needed to identify such trees to give treatment like improving anchorage and balance. If these are beyond repair and correction, these should immediately be removed. There should be a policy to remove such tree at least once in a year in a particular month.





**Picture 12: Dangerous tree standing by the roadside**

December could be suitable month for removal of such trees and also for pruning and training of other trees for long life. During this winter month, the chances of fungal infection are minimal.

### **Natural Factors responsible for tree damage & decline:**

#### **(I) Damage by insects and their control**

The insects are the integral part of our surrounding. They came on this earth before we did. In general, the insects are flora specific. But due to shortage of food and specific species, they develop an affinity for an alternate host to become polyphagous in nature. In fact, if we see the causes of insect invasion in epidemic form then any city can be divided into two areas: One the residences and the other, the open spaces. Unlike in the home gardens, not much is done by various agencies for the control of these pests in the cities and, therefore, the city flora becomes the breeding and spreading place for such insects. The un-built residences and the abundant houses contribute to the breeding and spread of these insects. There are many a kind of insect that appear from time to time but, the mango mealy bug, white ants, tree borers, tun fruit and shoot borer and red ants are a cause of concern. The appearance of the red ants is still only in pockets and on some of the tree species but their invasion is observed on an alarming speed. Likewise, the appearance of Tun fruit and shoot borer is also sporadic, spreading with alarming speed. The mealy bug has already reached almost all parts of the city.



**Mango mealy bug:** The mango mealy bug is the most familiar insect of mango trees. The adult female lays eggs in soil around the infested trees. The eggs start hatching with the fall of temperature i.e. in December-January and the newly emerging nymphs crawl up the tree trunk to reach the succulent shoots and base of fruiting parts.



**Picture 13:** The adults of mango mealy bug entering houses in sector 33

At the time of emergence from egg, the insect is dull brown coloured and is hardly a millimeter long. It thus goes undetected. At this stages, the nymphs start moving upward the trees and could be seen adhering around the entire inflorescence and other tender shoots to suck the sap. Mealy bug is known to devour on about 65 different plants species.

Their feeding process steadily weakens the branches, which leads to the premature fall of flowers and fruits. The honey dew exuded by the developing mealy bugs induces appearance of sooty mould near the affected region and causes necrosis of the affected parts. Photosynthetic activity is severely affected due to the development of sooty mould on the leaves. In Chandigarh, its attack was also noticed on Safeda, Guava, Jamun, bottle brush, litchi, Ficus spp., croton, hibiscus etc. During study, a close watch was kept on various avenues and different plant species. Earlier, it had been controlled to a great extent with PAU technique of using polythene band but complacence has again made it possible for the insect to reappear. The time of appearance of the insect is normally from Mid-December to March. During study, in the year 2012, it was first spotted on Madhya Marg in sector 19 on 3.1.12 and the ascend of the nymphs continued till the middle of March. The adults started



descending in the first week of April and vanished by 10<sup>th</sup> of May 2012. However, at a later date in June, when the nests of Red ants were opened, the mealy bugs were found actively sucking sap. This is due to the symbiotic relationship between the two species.

**PAU, Ludhiana Slippery Band technique to check upward movement of nymphs.**

The nymphs that emerge during December-January, are oriented to climb up the tree. The insect is a big menace as many of the nymphs that are disoriented start invading indoors climbing up the walls inside. They can also be seen in large numbers in the garden outside as well as outside walls. Though they are ultimately starved and bound to die, yet the crawling creatures are a big irritant. Crushed under the feet, they may leave a yellow spot that stays for a long time. As the insects crawl up and cannot fly, an easy and cost effective method is recommended and it is use of PAU slippery band.



**Picture 14: PAU Slippery Band for the Control of Mango Mealy Bug**

#### **Control**

1. Dig for light hoeing around the trees during summer to kill the eggs that are laid at about six inches depth.
2. Applying a 10 inches wide slippery band of 1000 gauge alkathene sheet around the tree trunk about a meter high from the base by mid-December. The sheet is secured with the help of shoe nails and the lower edge of the sheet is smeared with wet mud lest the tiny insects should move up from below the sheet.
3. In case of severe emergence of insects, apply follidol 2% dust on the compacted soil near the base of the tree to kill the emerging nymphs.



**The tree borers (*Inderbela species*)** : like mango mealy bug, this insect is also polyphagous and attacks a large variety of fruit trees like mango, citrus, guava, jamun, loquat, mulberry, pomegranate, ber, phalsa, sapota, aonla, litchi; a number of forest and ornamental trees like drum stick, arjun, silk cotton, amaltas, kusum, cassia spp., red cotton silk tree etc. The insect bores into the tree trunk and branches from the irregularly cut areas. They may also damage the branches at the crotches. The insect feeds below the web made from its own excreta and immediately retracts in the hole when approached. A severe infestation may result in drying of the stem but not of the main trunk though there may be interference with translocation of cell sap resulting in arresting of the growth of the tree and its fruiting capacity.



**Picture 15: Web of bark eating caterpillar (*Inderbela* spp.)**

The moths appear in May-June and start laying eggs with an incubation period of about 10 days. The caterpillar soon after emergence start feeding on bark and make web of excreta and bark pieces under which it feeds. The caterpillar is very long lived and continues destruction from May-June to April the next year. It may be 1.5-4.0 cm long. By the time of





**Picture 16: Bark eating caterpillar seen on Arjuna and Amaltas**

winter it is fully grown in size. With the rise in temperature the insects start pupating within the tree trunk or main branches and further activities started with the emergence of moth during monsoon. The larva continues damaging the trees throughout the year.



**Picture 17: Tree borer**



### Control

1. The attack of this can be minimized only by resorting to proper pruning of the trees. It should be done with the help of pruning saw or mechanical saw. The borer invasion is not possible through the round cuts and the least when the cut ends are treated/smeared with proper disinfectants. Such treatments also check the invasion by various fungi that cause die back or partial killing of the limbs and tissues.
2. Remove and destroy dead and severely affected branches of the tree.
3. Killing the larva by poking a wire down the tunnel or pouring kerosene into the tunnel and sealing it with clay during September-October and again in January-February gives complete control. The tunnel can be located by removing the web.
4. Plant the trees at proper distance to avoid overcrowding that encourages breeding.

**Termite:** The city of Chandigarh came up on most of the fellow or cultivated land. It is for this reason that tremendous infestation of white ants is found in the city. Since the insects live in underground colonies and tunnels, they are still there in large number even after six decades of the city's existence. The white ants being social insects live in colonies, underground tunnels or on the ground mounds made from plant matter, saliva and soil. The underground tunnels may extend up to few hundred meters. Thus the termites can remain hidden and well out of sight. Sometimes the shelter tubes extend up on the trees reaching from the soil to dead branches.



**Picture 18:** Mostly the attack of white ants is observed only when it is too late



Accumulated waste wood like stumps, tree tops or branches offer additional food for termites. Damage caused to the roots by JCB while extending roads also makes the plants weak and vulnerable to white ant attack. Poor sanitation and accumulation of dry grass and garbage below the trees is another potential breeding and feeding area. Heat conserved by paver blocks also kills the thin surface roots in the immediate vicinity and provide food for white ants.



**Picture 19: White ant colonies on Jan Marg**

They damage all the trees, vegetations that come on their way. One of the reasons of the white ants infestation is the dead wood material underground. Improper planting is a favourable factor for termite attack. The strangulating roots underground get damaged as they grow and rot to provide a potential point of entry for termites. Damaged bark left back as residue caused during tending, thinning and pruning invites termites. Such damage could be the result of falling trees, dried trees and debris from the snapping branches due to high wind. Thinning and pruning of branches done by nomads contribute to the malady as such waste material provides food for white ants.

### **Control**

It is important to control the white ants as they consume the tree and when their attack is noticed it is too late as the damage is irreparable. For the control of white ants, first of all it is very important to locate the colonies and destroy them. The colonies could also be fumigated. In home gardens too one could treat the soil using Chlorpyrifos 20 EC, at 0.2 percent. For this, the chemical is dissolved at two milliliter to a liter of water. To prevent the termite attack on the bark or the outer portion of the tree trunk, the mud is removed with broom or gunny bag and the trunk is washed with the above said



solution. After this, the tree trunk is white washed adding insecticide.

**Plants with termite resistance:**

As the white ants live in underground colonies and tunnels, it is quite difficult to control them as they shift leaving back the tunnels that come directly under treatment. It is, therefore, important to study the flora and locate those species that are comparatively resistant to white ant attack. The degree of resistance depends on the age and condition of the tree, the termite species and where the tree is growing. The indigenous species are more resistant than exotic tree species. One thing was, however, observed that there was not even a single tree species that was found resistant to white ant attack, only the degree differed.

**Red ants:** It was in the year 1979-80, I had for the first time seen the nest of red ants in the mango orchard in Khanpur Garden Colony, Kharar. The appearance used to be sporadic and we would control it using pesticide sprays. Over a period of time the population drastically decreased. In the year 2007 again I saw a few colonies in Chhatbir, in a mango orchard. My latest observation (2009) on this deadly pest is in Chandigarh as I saw the colonies in mango tree in Carbousier centre, sector 19 and on Mousari tree (*Mimusops elengi*) in Shanti kunj. The ants are spreading fast, at alarming speed in the city and have adopted many tree spp like Chukrasia, Arjun, Pilkhan, Molsari, Amaltas and Pongamia to make nests. Their damage to the tree is multi-pronged as they make nests by 'sewing' a number of leaves that dry at later stage affecting photosynthesis. They are not only deadly attackers causing immense pain but also support the nymphs and adults of certain coccids in their nest as they have symbiotic relationship. The coccids in the nest provide the ants with 'honey dew' and the ants provide



**Picture 20: Red ants attack on Arjun**





**Picture 21: Red Ant nest on *Picusbenjamina* in Shanti Kunj**

them the shelter. The ants even carry the coccids from one place to another without harming them.



**Picture 22: An opened nest of Red ants**

The red ants are in a way a big nuisance as their bite is quite painful. Once they invade the home gardens, it is quite difficult to remove them. It has to be a continuous fight to eradicate them.



***Terrartomaspillosa (Stink Bug)***: Kusum is another important tree in Chandigarh which is growing as avenue tree on Himalayan Marg and Madhya Marg. The tree is valued for its pigmented foliage at the time of emergence. Though commercially Kusum is grown as forage tree for lac insect, here in Chandigarh, it did not so far show any serious insect, pest and disease. However, during the course of study two strange factors were observed. The tree was found to have been attacked severely by litchi stink bug (*Terrartoma papillosa*). This is the first year that such insects have been found in all stages of growth on the same tree i.e. at egg stage, nymph and adult stage. Though its common name is Litchi Stink Bug it has not been observed on Litchi trees both in Home Gardens and in Orchards.



**Picture 23: Litchi Stink Bug (*Tessaratomia javanica*) attack was observed on Kusum at Himalayan Marg**

Though it is reported as sporadic pest of Kusum in Chandigarh, it seems to be attaining epidemic form as whole of the avenue plantation on Himalayan Marg was found to be severely affected. The species is damaging the foliage eating and sucking on young twigs.





**Picture 24: Damage of Litchi Stink Bug on Kusum**

Besides eating on leaf foliage, the damage on Kusum was observed as secretion of honey dew which leads to attack of many fungi including sooty mould.

**Red Cotton Bug:** As the name implies, the insect is known to attack cotton crop. But this was found to attack Kusum trees in the city. How it shifted its host to Kusum is a subject of further study.



**Picture 25: Red Cotton Bug on Kusum in Sector 17 Chandigarh**



The appearance of this insect on kusum trees is a surprise. The insect was found breeding on kusum trees, which seems to be unusual. They were found in all stages of growth on the trees.

**Leaf Blotch Miner:** There are certain plants that have high intensity of insect attack on them at any given time of the year. Pongamia is one such tree. The young emerging leaves are shining and bright green but as it ages, almost each leaf has insect attack of Leaf blotch miner. Pongamia is used mostly in parks and due to neglect, most of the trees are severely infested with this insect.



**Picture 26: Leaf blotch miner on Pongamia**

**Gall Insect:** Gall insect is the kind of insect that lives under protective cover and is, therefore, not easy to control. There are many a type of gall insects appearing on different type of flora. The injury caused by this insect on the leaves causes eruption and also appearance of many a fungal disease. The injured part of the leaves also turns brown and the tissues of the area die.





**Picture 27: Gall insect on lasoora**



**Picture 28: Gall insects on mango**

The attack of this insect is observed on many kind of flora and the shape of the galls is also different. The insect is controlled by the spraying of systemic insecticides like Metasystox or rogor.

**Mealy bug:** There are many species of mealy bugs, mango mealy bug being one of the very commonly found in the city. During the period under study, a heavy attack of a different species of mealy bug (*Icerya aegyptica*) was found on two of the tun trees on Madhya Marg, Sector 19. However, the next year, the insects were not found on the same tree or elsewhere in the city. There is a need to keep a close watch for the recurrence of the insect and its possible spread in the city.



**Picture 29: Another Mealy Bug species (*Icerya aegyptica*) found on Tun at Madhya Marg**



**Tun fruit and shoot borer: *Hypsipyla robusta* Synonym *Epicrocis terebrans*, (Cedar tip moth)**

This is another insect that has made its appearance in the city recently and is a cause of concern. The appearance of larvae in large numbers has been noticed in the last two to three years.



**Picture 30: Tun fruit and shoot borer hangs through web invading even houses and institutions**

The larvae hang down from the tree tops with a thread to go to soil wherever its attack is noticed. It makes the place a hell as the insects appear in thousands and start invading houses too. This insect also needs special attention before it becomes a nuisance for the city dwellers.



**Picture 31: Insects invading soil at Sacred Heart School is an annual feature now**



***Megacopta cribraria* (Fabricious):** There is a need to keep a vigil on the appearance of many new species of insects in this region. First they appear sporadically and then invade in the form of epidemic. At that stage it is then difficult to control them. *Megacopta cribraria* has been noticed on Bauhinia trees. An insect in case of stress of food or climate, takes other flora as alternate host to survive that difficult phase.



**Picture 32: *Megacopta cribraria* (Fabricious) on Bauhinia**

**List of Insects and Their Control:** The quantity is for mass spraying (500 liter of water) wherever required and can be reduced accordingly when used in home gardens. Experts should be consulted for proper and safe spraying.



**Picture 33: Bristle Beetle**



**Common Insect Pests and their control**

S. No.	Common name	Time of appearance	Control
1	Citrus psylla ( <i>Diaphorina citri</i> )	March to mid October	625 ml Nuvacron 36 SL
2	Citrus leaf miner ( <i>Phyllocnistis citrella</i> )	April-May, Sept-Oct	500 ml Sumicidin
3	Citrus whitefly ( <i>Dialeurodes citri</i> )	April-May, Sept-Oct	1250 ml Hostathion 40 EC
4	Citrus Black fly ( <i>Aleurocanthus woglumi</i> )	April-May, Sept-Oct	1250 ml Hostathion 40 EC
5	Aphids ( <i>Toxoptera aurantii</i> , <i>aphis gossypii</i> and <i>Myzus persicae</i> )	March- April	625 ml Nuvacron 36 SL
6	Mites	August-Sept	670 ml Rogor 30 EC
7	Leaf Folder ( <i>Psorosticha zizyphi</i> )	May-October	1250 ml Dursban 20 EC
8	Bark-eating Caterpillar ( <i>Indarbela quadrinotata</i> )	All the year through	Remove web and Inject kerosene oil into the holes
9	Citrus Thrips ( <i>Scirtothrips</i> )	March-April	1250 ml Hostathion 40 EC
10	Mealy bugs ( <i>Nipaecoccus viridis</i> , <i>Ferrisia virgata</i> , <i>Planococcus viridis</i> )	July-October	1875 ml Durmet/Dursban/Coroban 20 EC
11	Mango Hoppers ( <i>Amritodus atkinsoni</i> , <i>Idioscopus spp.</i> )	February-March	700 ml Rogor 30 EC
12	Mango Scale	All the year through	1500 ml Ekalux 25 EC
13	Stem Borer ( <i>Batocera rufomaculata</i> , <i>Hellula undalis</i> )	All the year through	Inject kerosene oil in the holes and plug the holes with mud.



14	Mango Shoot Borer ( <i>Chlumetia transversa</i> )	All the year through	Clear the web and inject kerosene oil in the hole. Plug the hole with clay
15	Red Ants ( <i>Oecophylla smaragdina</i> )	All the year through	Remove the nests and spray rogor 30 EC
16	Hairy-caterpillar ( <i>Euproctis spp.</i> )	All the year through	Collect and destroy eggs and remove the young caterpillar feeding gregariously
17	Spider mites ( <i>Eutertranychus orientalis</i> and <i>Tetranychus urticae</i> )	April-June	1000 ml Fosmite 30 EC
18	Leaf-hopper	All the year through	800 ml Rogor 30 EC
19	Fruit fly ( <i>Bactocera dorsalis</i> , <i>Carpomya vesuviana</i> )	July-August	1250 ml Sumicidin 20 EC
20	Peach Leaf Curl Aphid ( <i>Bracycaudus helichrysi</i> )	March-April	800 ml Rogor 30 EC
21	Peach Black Aphid ( <i>Pterochlorus persicae</i> )	April-June	800 ml Malathion 50 EC
22	Chaffer and other defoliating Beetles ( <i>Adoretus spp.</i> )	June-September	1000 ml Rogor 30 EC
23	Flat Headed-Borer ( <i>Sphenoptera dadkhani</i> )	Middle of March	Drench spray 1000 ml Durmet 20 EC (Chlorpyrifos)
24	Plum caseworm ( <i>Cremastopsychae pendula</i> )	April-May	1000 ml Rogor 30 EC
25	Grapevine Thrips ( <i>Rhipiphorothrips cruentatus</i> )	February-March, Sept.	500 ml Malathion 50 EC



26	Hopper ( <i>Arboridia viniferata</i> )	-	1000 ml Rogor 30 EC
27	Leaf Roller ( <i>Sylepta lunalis</i> )	July-August	500 ml Malathion 50 EC
28	Guava Shoot Borer ( <i>Microcolona technographa</i> )	All the year through	2000 ml Ekalux 25 EC (quinolphos)
29	Leaf Eating Caterpillar ( <i>Euproctis spp.</i> )	July to September	1500 ml Ekalux 25 EC (quinolphos)
30	Lac Insect ( <i>Kerria spp.</i> )	February to September	500 ml Rogor 30 EC. remove the dead twigs and scrap the branches before spraying.
31	Litchi nut borer ( <i>Blastobasis spp.</i> )	May-June	750 ml Sumicidin 20 EC
32	White fly ( <i>Bemisia tabaci</i> )	All the year through	250 ml Malathion 50 EC dissolved in 250 ml of water
33	Tobacco caterpillar	July- September	Destroy gregarious caterpillar by plucking infested leaves. Spray 1000 ml Ekalux 25EC
34	Red Pumpkin beetle ( <i>Aulacophora foveicollis</i> )	February-April	1000 ml Ekalux 25 EC
35	Red spidermite ( <i>Tetranchu spp</i> )	All the year through	200 ml of malathion 50 EC dissolved in 100 litres of water
36	Fruit borer ( <i>Helicoverpa armigera</i> )	May-June	100 ml of Sumicidin 20 EC dissolved in 100 litres of water
37	Jassid ( <i>Amrasca biguttula</i> )	May to September	100 ml of Sumicidin 20 EC dissolved in 100 litres of water
38	Hadda beetle ( <i>Elapilachna spp.</i> )	-do-	-do-
39	Spotted bollworms ( <i>Earias spp.</i> )	-do-	Apply 8 kg Thimet 10G at sowing and spray 250 ml Rogor 30 EC dissolved in 100-125 litres of water



40	Pod borer or Blue butter fly	April to July	250 ml Malathion 50 EC in 80 liter of water.
41	Onion thrips ( <i>Thrips tabaci</i> )	February to May	250 ml of Mlathion 50 EC dissolved in 80 litres of water
42	Onion maggot ( <i>Delia antiqua</i> )	January-February	4 kg Thimet 10G
43	Pea thrips ( <i>Thrips indicus</i> )	August to October	Spray 400 ml of Rogor 30 EC dissolved in 80-100 litres of water dissolved
44	Pea Leaf miner ( <i>Chrotomyia horticola</i> )	400 ml Rogor 30 EC in 80 liter of water	Spray 400 ml of Rogor 30 EC dissolved in 80-100 litres of water dissolved
45	Pea aphid ( <i>Acrythosiphon pisum</i> )	-do-	Spray 400 ml of Rogor 30 EC dissolved in 80-100 litres of water dissolved
46	Pea stem fly ( <i>Ophiomyia phaseoli</i> )	September-October	Apply 3kg Thimet 10G or 10 kg Furadan 3G
47	Diamond-back moth ( <i>Plutella xylosstella</i> )	August –November	100 ml of Sumicidin 20 EC dissolved in 100 litres of water

**Table 4 Common Insect Pests and their control**

**Source : Punjab Agriculture University (PAU) Ludhiana Literature**

#### **Damage by Diseases and their control**

The decline in the tree health is attributed to multiple of reasons that include fungal diseases, insect's infestation, physical injuries and blockages. Some of the fungi like ganoderma are indicative of drying tissues in the tree which should be kept under surveillance. The growth of this fungal fruiting bodies was observed on almost all the drying trees some of these being Kusum, *Cassia siamea*, *Ficus infectoria* etc. It is indicative of the drying or dying of limbs due to one or the other reasons. The examples are Poria fungus, a flat mass, noticed on Chukrasia, Pilkhan and Fomes fungus, a bulging mass, found on Imli plantation and Pongamia. Imli also had wood rotting fungi as verified by the plant disease clinic at PAU. (Ludhiana)

In India, *Fomes senex* has caused a heart-rot of living trees in over-mature trees, while *Fomes lividus*, a very common decay fungus with white mass appearing on limbs was observed both, in Chukrasia planted in the imli avenue and also on Imli.





***Picture 34: Fomes lividus fungus growing on Chukrasia at Madhya Marg***



***Picture 35: Wood rotting fungi an indication of deteriorating plant health***





**Picture 36: *Ganoderma*, an indicator of dead and drying tissues on a tree**

In most of the cases, the insects and fungi are common to various tree species grown for urban plantation and those growing in the home gardens. But during the study many an insects and diseases were noticed that were unidentified. A close look at various tree species revealed the presence of horde of fungi that need further study to find out their implications.



**Picture 37: Fungus fruiting body found growing on half dead pilkhan tree on Madhya Marg**





**Picture 38: Poria fungus on Chukrasia.**



**Picture 39: Fungal fruiting body that need investigation**

#### Common Diseases and Their Control

S. No.	Common name and their Causal organisms	Time	Control
1	Canker ( <i>Xanthomonas campestris</i> pv. <i>citri</i> )	October, December and January	Three sprays of 50g strepocycline plus 25g copper sulphate in 500 litres of water
2	Scab ( <i>Elsinoe fawcettii</i> )	Last week of June to August at 20 days interval	Three spray of Dithane M-45 (0.25%)
3	Gummosis /Foot Rot ( <i>Phytophthora palmivora</i> )	All the Year Through	Scrap and apply Blitox Slurry /Apply on Soil Ridomil Gold 25gm, dissolved in 10 ltr. of water in February and July
4	Wlther Tip ( <i>Anthraco</i> nose)	March, July and September	Spray with Bordeaux mixture (2:2250) or 50% copper oxychloride (0.3%)



5	Melanose or Stem and Fruit Rot ( <i>Phomopsis citri</i> )	July, August and September	Spray with Bordeaux mixture (2:2250) or 50% copper oxychloride (0.3%)
6	Greening (Virus)	All the year through	Use disease free bud wood. Since it is spread through insect vector, citrus psylla, keep the same rigorously under check through recommended insecticidal sprays.
7	Tristeza (Virus)	All the year through	Use disease free bud wood and only tolerant rootstocks such as JattiKhatti.
8	Exocortis (Viroid)	All the year through	Use disease free bud wood and only tolerant rootstocks such as JattiKhatti.
9	Ring Spot (Virus)	All the year through	Use virus free plants for raising the citrus orchard.
10	Mango Malformation ( <i>Fusarium moniliforme</i> , virus or fungus, environmental factors)	October	Dissolve 100g Naphthalene Acetic Acid (NAA) in 100-150 ml alcohol and make the volume upto 500 litres.
11	Powdery Mildew ( <i>Microsphaera mangiferae</i> , <i>M. alphitoides</i> )	Before flowering, during flowering and after fruit set	Spray 500 ml Karathane in 500 ml of water.
12	Anthracnose or Dieback ( <i>Colletotrichum gloeosporioides</i> , <i>Elsinoe ampelina</i> , <i>Gloeosporium psidii</i> , <i>Phytophthora parasitica</i> , <i>Rhizopus sp.</i> , <i>Aspergillus spp.</i> )	All the year through	Prune the infested shoots



13	Twig Dieback or Leaf Blight ( <i>Macrophoma mangiferae</i> )	-do-	Immediately after pruning, apply the disinfectant solution to the cut ends followed by Bordeaux paint. Thereafter, spray with Bordeaux mixture (2:2:250)
14	Stem-Canker ( <i>Schizopyllium commune</i> )	-do-	Spray Bordeaux mixture (2:2:250) or 1.5 kg copper oxychloride in 500 ml of water at fortnightly intervals.
15	Black tip	Before flowering, during flowering and after fruit set	Spray three times with 0.6% Borax along with Bordeaux mixture (2:2:250) or 1.5 kg of copper oxychloride in 500 litres of water.
16	Pear Scab ( <i>Venturia pyrina</i> )	Start from dormant stage and continuing till petal fall at 10 days intervals	Spray 0.2% Captan
17	Shoot/Fruit-Blight and Bark canker ( <i>Phoma glomerata</i> )	February to September	Bordeaux mixture (2:2:250)
18	Root-Rot and Sapwood Rot ( <i>Polyporus palustris</i> )	January and March	Spray Bordeaux mixture 0.3% copper oxychloride 50% (1.5kg in 500 litres of water).
19	Shot Hole ( <i>Stigmia carpophila</i> )	Leaf fall or bud swelling stage	Spray with Ziram or Thiram (0.2%)
20	Bacterial canker and Gummosis ( <i>Pseudomonas monaprumonum</i> )	Before the commencement of rains	Apply Mashobra Paint after cleaning the wounds.



21	Brown Rot ( <i>Sclerotinia fructicola</i> and <i>S. fructigena</i> )	All the year through	Collect and destroy the fruit mummies by burning them in soil. Spray Captan @ 0.2% about three weeks before harvesting the fruits.
22	Cercospora Leaf Spot ( <i>Cercospora spp.</i> )	All the year through	Spray Bavistin 50 WP dissolved at 500 g to 500 litre of water.
23	Downey Mildew ( <i>Plasmopara viticola</i> )	Mid-September	Spray Bavistin 50 WP dissolved at 500 g to 500 litre of water and one additional spray of Bordeaux mixture (2:2:250).
24	Foot rot or Collar rot and Stem rot ( <i>Rhizoctonia spp.</i> , <i>Pythium aphanidermatum</i> and <i>Phytophthora palmivora</i> )	All the year through	The cuttings before planting should be dipped into 0.2% Ziram suspension. The soil in the pit should be drenched with 0.4% Captan (400g in 100 litre of water) thoroughly before planting the cuttings.
25	Rotting of berries ( <i>Black mould rot</i> , <i>blue mould rot</i> )	June	Spray 0.2% Ziram at 7 days interval. Stop spraying week before harvesting the bunch.
26	Wilt ( <i>Fusarium sp.</i> , <i>Rhizoctonia sp.</i> , <i>Cephalosporium spp.</i> )	All the year through	Avoid too heavy soils. Drench the soil in the pit with 2 per cent Formalin and covered with sarkanda and old wetted gunny bags.
27	Fruit Rot ( <i>Gloeosporium psidii</i> , <i>Phytophthora parasitica</i> , <i>Rhizopus spp.</i> , <i>Aspergillus spp.</i> )	During rainy crop	Rain and irrigation water should not be allowed to stand in the basin around the tree. After pruning, spray 300g of Blitox in 100 litres of water.



28	Leaf Mould and Leaf Spot ( <i>Isariopsis indica</i> and <i>Phoma macrostoma</i> )	August-March	Spray with Bordeaux mixture (2:2:250) or with 0.3% copper oxychloride.
29	Black Fruit Spot ( <i>Alternaria alternata</i> )	End January and mid-February	Spray with Mancozeb 75 WP dissolved at 2.5g to a litre of water.
30	Papaya Mosaic ( <i>Virus</i> )	Summer months	Uproot and destroy the leaf curl affected tree immediately. Spray 250 ml of Malathion 50 EC in 250 litres of water against the vectors, viz. aphids and white flies before the virus attack begins.
31	Papaya Leaf Curl ( <i>Virus</i> )	All through the year	Same as for papaya mosaic.

**Table 5 Common Diseases and Their Control**

Source: PAU, Ludhiana Literature

### Calendar of Operations for city trees

One of the main reasons of the tree decline in the city is due to lack of plant protection. For the information of the concerned departments, a chart has been prepared for ready reference. The tree life can be prolonged if timely operations are carried.

#### CALENDER OF OPERATIONS FOR CITY TREES

S. No	Name of tree	Insect/disease	Time of appearance/occurrence	Control
1	Mango, Arjun, Silver oak, Ficus spp. (with more affinity) and almost all the other trees of Chandigarh	Mango mealy bug	Mid December-April, May	Mark the affected trees. Use PAU Slippery band. Sprinkle Follidol 2% near the base of the tree where the insects appeared last season.
2	Arjun, Amaltas (with more affinity) and almost all the other spp.	Bark eating caterpillar ( <i>Indarbela quadrinotata</i> )	January-February, August-September	Inject kerosene oil into the holes in tree trunk during attack period.



3	Mango, <i>Chukrasia</i> , <i>Arjun</i> , Pongamia, <i>Pilkhan</i> , <i>Moulsari</i> , <i>Inga dulcis</i>	Red ants ( <i>Oecophylla</i> <i>smargdina</i> )	All through the year	Remove the nests and burn them
4	Mango, <i>lasura</i> , <i>Alstonia</i> , <i>Arjun</i>	Gall insect	All through the year	Confidor 17.8 SL dissolved at 0.4 ml (for <i>Alstonia</i> ) and 2-2.5 ml to a litre of water (in Mango, <i>Arjun</i> and <i>Lasura</i> ) in February- March and August- September
5	<i>Kusum</i>	Longon Stink bug	Summer and all through the wet season	Spray rogor (dimethoate), dissolved at 2 ml. to a liter of water.
6	All the tree spp. with no exception	White ant	All through the year	Soil treatment with Chlorpyriphos and white washing the main trunk mixing insecticides with the white wash
7	<i>Schleichera</i> <i>trijuga</i> ( <i>kusum</i> )	Red cotton beetle g ( <i>Dysderkus</i> <i>Koenigi</i> )		Metasystox 25 EC @ 1.5 ml/ltr Or Rogor 30 EC @ 1 ml/ltr
8	<i>Chukrasia</i> , <i>Pilkhan</i> , <i>Cassia</i> spp.	Poria		Bordeaux paint or paste or Copper sulphate solution @10gm/liter of water.
9	<i>Imli</i>	Fomes		Bordeaux paint or paste or Copper sulphate solution @10gm/liter of water.
10	All the tree species	gumming	All through the year	Remove the gum with a sharp knife till healthy tissue appears. Smear the wound with Bordeaux paint.
11	All the tree species	Irregular cut ends	-do-	Round the cuts with saw and smear the cut ends with Bordeaux paint.

Table 6 Calender Of Operations For City Trees





**Picture 40: Poria fungus on Chukrasia needs**



**Picture 41: Fungal fruiting body that investigation**

### **Weeds and wild climbers**

Most of the insects thrive on a particular kind of flora but during stress period they go out looking for alternate host. Such insects thus thrive the adverse conditions like shortage of food and harsh climatic conditions. Bristle beetle is normally found feeding on various ornamental species with special affinity for hibiscus shrub but could be seen on alternate hosts, mostly weeds. It is, therefore, important to remove weeds periodically so as not only to break the food chain but also kill the eggs and young ones of the various insects using weeds as alternate hosts.

The weed infestation is one of the biggest problems as they become a source of infection and infestation for diseases and insect respectively. Weeds also rob on the plant nutrition.

Some of the perennial weeds like congress grass that come up on unattended stretches of land should be physically removed during rainy season. There is no other effective way of getting rid on this perennial weed. Use of shrub master or grass cutting sword spreads the weed. In case of weed management sanitation is utmost importance. If the removed weeds are left back they again catch roots in no time and there is every possibility of seed shedding. It is because of these reasons that one can see different weed at different stages of development at the same place.

It is also advised to remove weeds and wild climbers growing along the avenues. However, it is not advisable to clear the earth of the growth especially during summer months as there is soil wind erosion at that time. Such growth also slows down the surface runoff. There is need for a constant vigil against the appearance of Cuscuta, the Amar bel on avenue trees. This fast growing parasite



completely covers the whole of the tree canopy completely cutting down the tree photosynthesis process. This makes the tree weak, pale and sickly It ultimately dies. The Cuscuta has to be completely removed from the tree and care should be taken not to leave even a small fraction of it on the tree or hedges otherwise it grows again. Such operations should be thorough and done with patience. After removal, it should be destroyed by burying.



**Picture 42: Cuscuta, the Amar Bel completely covers to kill the tree**

### **Gardens and Parks**

As there is hardly any plant protection measure taken in gardens and parks, these have become the source of infection and the breeding ground for various insect, pest and diseases. All those insect, pest and disease that have been found on City Avenues are also infesting parks and gardens. This observation was recorded while visiting various city parks and gardens. As most of the gardens and parks are in the immediate vicinity of the homes and home gardens, there is frequent shifting of the pests in both directions. It is therefore, of utmost importance to not only control pests in these gardens but also to educate the home gardeners to do so to get effective control.



### Home Gardens

The urban planting and the plants in the home garden affect each other's health. The home gardens may act as a host for various plant insects and diseases and vice-versa. The unattended plots/houses are the most suitable breeding ground for insect and diseases that spread to the neighbouring houses and the trees outside of the houses in the near vicinity. The institutions that leave their gardens unattended also immensely contribute to various tree maladies. Unlike, the city trees the fruit bearing home garden trees need regular cutting, pruning and rejuvenation or else they become unfruitful. Their growth should also be regulated lest they should cause shading the other trees, lawn etc. In case proper plant protection measures are not taken the insects and disease spores spread to outside plants. The people participation in keeping the city green is a must as there is not much difference in the flora inside and outside of the home gardens. The insects, pests and diseases prevalent in home gardens and also most of which are common with the city plantation have been identified and listed below. Utmost care should be taken to control insect, pest or diseases as a neglect may lead to poor



**Picture 43 : Lemon Butterfly larvae in the home garden**

performance and the tree may also decline over the years. The short duration crops like vegetables may die within a few days. The chart given hereunder will be a ready reference for home gardeners.



***Nutritious but forgotten Fruits, should form a part of Home Gardens***



***Picture 44: Amia***



***Picture 45: Phalsa***

***Picture 46: Karonda***



### Other Aspects of city planting

During this study, it was felt that information should also be collected on certain other aspects of horticultural importance in the city. One of the points of interest was the planting in the road central verges. There are locations where the central verge is hardly one to one and a half feet wide and the plant species used is that of *Ficus* tree species. The same strip also has underground electrical lines! The highways passing through the city and entry points connecting the city with other states were also studied. The highways are normally on the periphery of the cities and the entry and exit points are the face of a city. There are commuters who do not enter the cities and just use the city as a transit channel to go to other states. For those commuters, the city impression meant the outer passage. Effort should be made to maintain the route in such a way that the passage is memorable for commuters.

While making the planting plan, the climatic conditions, rainfall, soil type and the inclusion of local flora for suitability and hardiness should be taken into consideration. Planting of mixture of flora with different crown shapes, rate of growth and incompatibility should be avoided as it may become a cause of high tree mortality rate, besides giving the highways a patchy appearance and a staggered skyline.

Chandigarh is comparatively better planned than other cities. However, there is always scope of improvement. Let there be a 'Tier system' of planting i.e., small, medium and tall trees planted in succession from the edge of the road towards the outer periphery wherever feasible. This will not only give a harmonical co-existence but an aesthetic skyline too. Such plantations could be interspersed and sprinkled with trees like Simbal (*Bombax ceiba*) or Chorisia (*Chorisia speciosa*) that are sturdy and have magnificent trunk besides bearing beautiful flowers, Dhak (*Butea frondosa*) for spectacular display of scarlet red blooms or Erythrina (*Erythrina indica*) with deep blood red blooms on leafless tree (especially in dry areas) or Amaltas (*Cassia fistula*) with sparkling yellow clusters of blooms. This will not only break the monotony but prove refreshing for the road users.

Planting of fruit trees should be avoided along the highways especially the likes of Jamun (*Eugenia jambolana*) which, besides having brittle branches that snap with even a little higher wind velocity, bear fruit that attract the stone hurling urchins. Similarly, trees like Millingtonia (*Millingtonia hortensis*), Siris (*Albizia lebbek*), Kassod (*Cassia siamea*) etc should be avoided as they too have brittle branches. One of the basic aims of the highway plantation is shade and the planting of trees with linear growth like Eucalyptus etc should also be avoided. Eucalyptus normally bends dangerously and is a potential danger for the road users. Trees like White Siris (*Albizia procera*) should be planted sporadically at regular interval as their light coloured main trunk reflects even the minutest of light on the highways at night, even upto 130 meters. This is in contrast to the brown bark trees like Mahogany (*Swietenia mahagony*), Neem (*Azadirachta indica*), Mango (*Mangifera indica*) etc



that are not visible even at 30 meters. Similarly, no hard structure like small walls, tree mounds and round cement structures etceteras should be allowed to be built within a few feet of the road edge. Most of the time such structures are the cause of fatal accidents. The first tree line should be at least 8 to 10 feet away from the edge of the highway. In case where road widening has been done, even the patch of a few closely planted trees (say five to ten) coming very near to the edge of the road, say three to four feet, should also be removed or else provided with strong road reflectors.

In case of the highways passing through the cities, the basic considerations are shade and aesthetics. Different tree species could be selected depending upon the need. Trees like *Chukrasia* (*Chukrasia tabularis*), *Mahogany* (*Swietenia mahagony*), *Moulsary* (*Mimusops elengi*) *Kusum* (*Shielchera trifuga*) with red new growth, *Koelreutaria* (*Koelreuteria apiculata*), with three colours on the same tree at the time of bloom etc. are very suitable for shade and beauty.



**Picture 47: *Chukrasia* on the outer DakshinMarg**

The other considerations could be for **screening effect, dust proof and sound barrier** and for that we could use bamboo, *Ficus lyrata* or *Kanak Champa* (*Pterospermum acerifolium*). For colour; one could include *Amaltas* (*Cassia fistula*), *Gulmohur* (*Dalbergia sisoo*), *Nilll Gulmohur* (*Jacaranda mimosifolia*), *Erythrina* (*Erythrina indica*) etceteras. These species could be considered for planting on big rotary berms too. Under no circumstances, the following trees should be planted on city roads:



**Arjun:** The big pod like fruit of the *Arjun* trees fall on the ground from June end to August badly littering the roads. These pods float with every rain to block sewerage system. The tree is also very prone to stem borer that damages the tree from within besides eating on its bark. The hollowed tree trunk and branches snap with rains and winds. The bark is mostly removed by people for medicinal purpose causing immense damage and shabby look



**Picture 48:** Sewerage blockade with *Arjun* seed capsules

**Jamun:** If you want to kill any tree, tell its medicinal value to the people. Most of the people, unmindful of the consequences, scrap away the bark of mango, neem, *Jamun* and *Arjun* tree. Such like damage and also the one caused by irregular cutting of stems and trunk using crude equipments like *Gandasa* and axe, lead to invasion by trunk borers like *Indarbela* species causing the same kind of damage as stated earlier. Moreover, the fruit trees like *Jamun* and mango when used attract children who throw stones that could prove dangerous by the road users and passer-byes.

Any beauty spot along the highway could leave a memorable impression on the mind of travelers and visitors.





**Picture 49: Feature created with Golden Bottle Brush**

### **Recommendations**

The decline in the tree health is attributed to multiple of reasons that include fungal diseases, insect's infestation, physical injuries and blockages. Some of the fungi are indicative of drying tissues in the tree which should be kept under surveillance. These show the drying or dying of limbs etc. due to one or the other reasons. e.g. *Poria* fungus, a flat mass, noticed on *Chukrasia* tree and *Fomes* fungus, a bulging mass, found on *Imli* plantation is an indication that there is something amiss.

1. Normally, in urban planting we forget the trees after planting and seldom take any plant protection measure with the result that there is aggravation over a period of time.
2. There is a continuous need for vigil against removal of limbs of the trees growing on residential side by the residents causing lop-sided growth of the trees on the roadside.
3. Adequate attention should be given to the fungal growth (*Ganoderma*) that appears on dead tissues indicating decay on tissues including the base of the tree, the underlying cause should be identified and appropriate measures like treatment against white ants or root rot diseases etc. should be taken immediately.
4. In case of avenue plantation, all those branches, limbs, twigs that have downwards orientation should be clipped up to the height of at least 10 to 15 feet so as to ensure smooth traffic movement.
5. All the dead/diseased trees need immediate removal to avoid any damage to life and property. These are also potential source of disease and insects. The dead trees should be replaced by the same species that form the avenue. In general, survey should be done in the month of December to



identify and remove such trees.

6. Burning of leaves and twigs is an offence but it is hardly enforced. The leaves are collected under the trees left there for a few days and then burnt by safai karamcharies. There is need for strict compliance as it is not only health hazard and harmful for the trees but also obstructs road visibility making it dangerous for the road users.
7. The trees that have overhead lines are badly damaged by the use of unconventional equipments. Any such operation should be carried out under the supervision and guidance of horticulture department. Remedial measures should be taken to mend the damage. The affected trees with lopsided growth should be identified and corrective measures should be taken to balance the growth. This will save them from falling during rains or due to high wind velocity.
8. Smooth cut should be given with the help of a mechanical/electronic pruning saw to all those limbs that have been cut/sliced irregularly and unscientifically. The cut ends should be treated with a disinfectant like Bordeaux paint, copper oxy-chloride etcetera.
9. On receiving a complaint about appearance of bee colonies on trees in the city, the corporation staff visits to burn the nest by the heavy use of kerosene oil and torching the hive with fire gun killing the bees instantly. This is not only unscientific but against the nature as the bees are friend insects. There are scientific ways of removing the hives without killing the useful insects. There is a need to sensitize the staff and educate them. For help in such cases, they could approach PAU for guidance.
10. There is a need for immediate control of tree borer (*Indarbela* spp.) that has severely infested the trees. Remove the web that includes the insect excreta to locate hole in the stem. Inject kerosene oil in the hole. Plug the hole with mud.
11. The appearance and attack of termite is a perennial problem in Chandigarh and the insect attack almost all the tree species. Treat the soil with insecticidal solution of 0.2% Chlorpyrifos 20 EC. It may be applied all around the tree. To prevent the termite attack on the bark or the outer portion of the tree trunk, brush painting with white wash mixed with the insecticide may be done after scrapping off the earthen plaster or galleries. Such spot treatments should be carried out frequently.
12. To control mealy bug, a serious pest appearing in the city each year, wrap alkathene sheets around tree trunk by 15th of December every year as that is the time for mealy bug nymphs to crawl up the trees. In case of severe emergence apply follidol dust 2% on the compacted soil to kill the nymphs.
13. There should be judicious selection of tree and shrub species for a particular location. While planting, the selection of species should be based on availability of space, both for root zone and canopy. Under no circumstances the tree species should be planted in the road centre verge where



width of the verge is less than 15 feet. The difference between planting of particular species as avenue trees, planting in the parks and gardens and those on road central verge should be understood and planting should be done accordingly.

14. As the red ant has just appeared and its infestation is sporadic, it should be eliminated by holding special campaigns lest it should be too late. The ant nests should be identified, removed and destroyed. Affected trees should also be sprayed.
15. Fill the gaps especially in the avenue plantations immediately with the same species during the monsoon season to ensure the continuity and aesthetic look to the avenue plantation. In case of mixed avenue plantation the gaps should be filled with the species that is in majority.
16. It has been observed that there is unauthorized removal of wood for the purpose of fuel, fodder or monetary benefits by nomads, which causes immense damage to the trees during winter months. At that time, one could see the wood being carried on cycles, rickshaws, horse carts or even over head in the evening hours. The concerned department should be instructed to step up vigil and to discourage such practices that are causing damage to the greenery of the city.
17. At this time, when the horticulture sector is getting a boost world over due to a new concept of Garden tourism, the cities like Chandigarh that have tremendous scope for horticultural development. The city should have a full fledged independent department of horticulture manned by horticulture specialists only. The decision making on carrying out different operations as to what-to-do-and-when in horticulture should rest with the specialists only.
18. Compaction of soil, concreting and tiling around trunk adversely affects its growth and life. It also reduces/stops percolation of rain water into the sub soil and stops proper soil aeration. At least an area of 6 to 8' on all sides should be left around the tree trunk
19. One of the reasons of the deteriorating health of the trees in the city is poor anchorage, damage to the roots and piling of the mud etc around the trees. It is due to the unending task of making trenches along the road and then piling up the mud and malba with the excavated soil. The piled up mud also conserves moisture and becomes potential danger to the bark and the phloem in the immediate vicinity that starts rotting. It also becomes a perfect breeding place for the insect/pest and diseases. There is also no provision left to provide plant protection by using chemicals that need to apply in the root zone.
20. There is a need to form an Insect-pest Monitoring Committee that should hold periodic meetings and visit various city gardens and avenues to see the condition of trees and appearance of pests and diseases and suggest proper plant protection measures. They should also keep an eye for appearance of any new insect-pest or disease and get it identified. Immediate steps should then be taken to control the problem. The development staff should be given periodical orientation/training in the latest technology so that the city trees could be reared scientifically.



## Annexure-I. Manuring Schedule for fruits plant.

Crop	Age (years)	Farmyard manure (kg/plant)	Fertilizers (g/plant)			Time and method of application
			CAN/ Sulph.	Superph- Muriate of Amm. Osphate	Potash	
1	2	3	4	5	6	7
Citrus	1-3	5-20	200-600	----	-----	Apply farmyard manure in December Spilt CAN in two doses. Apply 1st dose in February and the second dose in April-May
	4-6	25-50	800-1000	----	-----	
	7-9	60-90	1200-1600	-----	-----	
	10 & above	100	1600-3200	-----	-----	
Peach	1	10	360	190	150	Apply farmyard manure during December along with superphosphate and Muriate of Potash. Apply ½ CAN in spring before flowering and the rest ½ of CAN one month later.
	2	15	720	380	300	
	3	20	1080	570	450	
	4	25	1450	760	600	
	5	30	1800	950	750	
	6 & above	35	2160	1140	1000	
Plum	1	6	120	95	60	Apply farmyard manure in December along with superphosphate and Muriate of Potash. Apply half of CAN in spring before flowering and the remaining half one month later
	2	12	240	190	120	
	3	18	360	285	180	
		24	480	380	240	
	5	30	600	475	300	
	6 & above	36	720	570	360	



1	2	3	4	5	6	7
Litchi	1-3 3-6 6-10 10 & above	10-20 25-40 40-50 60	300-1000 1000-2000 2000-3000 3500	200-600 750-1250 1500-2000 2250	60-150 200-300 300-500 600	Farmyard manure, superphosphate and Muriate of Potash should be applied in December. Half CAN should be applied in middle of February and the rest half in the middle of April after Fruit setting.
Grape	1 2 3 4 5 & above	20 35 50 65 80	800 1000 1200 1600 2000	1000 2500 3500 4000 4500	250 350 500 650 800	Apply whole of farmyard manure superphosphate and $\frac{1}{2}$ CAN and $\frac{1}{2}$ Muriate of Potash after pruning. Apply the remaining CAN and Muriate of Potash in April. Spilt CAN and muriate of potash into three doses for the vines planted at 3 m x 5m. Double the dosage if planting distance is 3mX 3m.
Guava	1-3 3-6 6-10 10 & above	10-20 25-40 40-50 50	300-400 600-1200 1500-2000 2000	500-1500 1600-2000 2000-2500 2500	100-400 600-2000 1100-1500 1500	Farmyard manure should be fertilizers should be applied during May-June and the remaining dose in September-October.
Pear	1-3 4-6 7-9 10 & above	10-20 25-35 40-50 50	200-600 800-1200 1400-1800 2000	200-600 800-1200 1400- 1800 2000	150- 450 600- 900 1050- 1300 1500	All the farmyard manure, Superphosphate and muriate of potash should be added in December. Half of CAN should be added in early February before flowering and other half in April, after fruit set.



Phalsa	-----	10-15	1000	----	-----	Apply farmyard manure in December and CAN in January just after pruning.
Papaya	1 2 & above	--- 20 twice a year	---- 140	280	80	Add ½ kg of fertilizer mixture i.e. Ammonium sulphate, superphosphate and potassium sulphate in the ratio of 1:2:1/2 twice a year (February and August), along with 20 kg farmyard manure. No fertilizer should be added to the soil in the year of planting.
Ber	1 2 3 4 5 & above	20 40 60 80 100	400 800 1200 1600 2000	---- ---- ---- ---- ----	---- ---- ---- ---- ----	Apply whole of farmyard manure in May-June, Spilt the CAN dose. Apply first 1 during July-August and the other, soon after the fruit set.
Mango	1-3 4-6 7-9 10 & above	5-20 25-50 60-90 100	200-400 400-800 800-1000 1000	250-500 500-750 750-1000 1000	175- 325 325- 650 650- 1000 1000	Apply whole of farmyard manure and phosphatic fertilizer in December, whole CAN and muriate of Potash in February during off years. During on year apply one kg more of CAN in June.