



Plant Archives

Journal homepage: <http://www.plantarchives.org>

DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2024.v24.splcialissue.026>

EFFECT OF ROADSIDE DUST POLLUTION ON COCOON PRODUCTION OF TASAR SILKWORM *ANTHRAEA MYLITTA* D

Jitendra Singh, Rahul Kumar, Susmita Das, Hanmand Gadad, Harendra Yadav,
Devashish Chattopadhyay and N.B. Chowdary

Central Tasar Research and Training Institute, Central Silk Board, Ranchi -835303

ABSTRACT

An experiment was conducted at Central Research and Training Institute, Ranchi for assessment of roadside dust pollution on cocoon production of tasar silkworm *Antheraea mylitta* D during 2018-19 in second crop season. Asan & Arjun, primary food plants of tasar silkworm were selected for field experiment and distance of these plants from roadside were viz., 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 and 60 meter respectively in plot number 4 and plant number 5. 150 larvae were brushed on each distance interval on tasar food plants. The highest numbers of cocoon production (35 cocoon/150 larvae) was found in highest distance at (60 meter) from roadside whereas lowest cocoon production was observed near to roadside in Arjun plants. In case of cocoon weight highest cocoon weight (11.96g/cocoon) was observed in highest distance from road in Arjun plant. Highest shell weight (1.91g/cocoon) was observed also in highest distance from road in Arjun plant. The Highest SR% 16.57 was found at 55 meter distance and lowest SR% is in cocoons of arjun plants at 15 meter distance. Similar results were also observed in tasar on asan plants viz., number of cocoon, cocoon weight shell weight and SR% respectively. The highest dust pollution (dust/leaf) was observed (1.94 / leaf) near to roadside in Arjun plant whereas lowest dust deposited (0.13g/leaf) highest distance from roadside. Similar result was also observed in Asan plant. Filament length (m), filament weight and NBFL were very low (near one third) in 20-40 meter distance from roadside as compare to control in Arjun food plant. Similar trend was also observed in Asan food plants. Management of dust pollution during rearing season in tasar culture will not only enhances the quality tasar production but also enhances the farmer's income.

Keywords: Dust, tasar cocoon, SR%, Filament length, NBFL etc.

Introduction

Sericulture is a short gestation period labour intensive enterprise which can go a long way in promoting inclusive growth and alleviating poverty in rural areas. Tasar silkworm, *Antheraea mylitta* Drury is extremely polyphagous and differs in its adaptation to different food plants. Though more than two dozen primary and secondary food plants have been reported, *Terminalia tomentosa* (Asan), *T. arjuna* (Arjun) and *Shorea robusta* (Sal) hold commercial importance. These food plants are predominantly distributed in the forests of Jharkhand, Chhattisgarh, Odisha, Madhya Pradesh, West Bengal, Andhra Pradesh and Maharashtra. Traditionally, the rearing of tasar

silkworm is conducted on naturally grown trees of Asan, Arjun and sal in forests.

Roadside plant leaves are in direct contact with air pollutants, and may act as stressors for pollutants, hence need to be examined for their bio-monitoring potential (Sharma *et al.*, 2007). Bio-monitoring of plants is an important tool to evaluate the impact of air pollution (Rai, 2011a, b). Accumulation of dust particles depends on inter nodal distance, petiole length, leaf area, orientation, margin, folding and arrangement, hair density, hair type and length (Yan and Hui, 2008). Dust pollution is an important issue to be considered to maintain the safe quality of ambient air. Crushing units operating for production of large quantity of aggregates deposit dust particles in

surrounding atmosphere. The plants and land exposed to heavy dust pollution shows variations according to the density of falling dust particles. The cover formed by deposition of dust particles decrease the pigmentation of plant leaves. The physical and chemical properties of plant tissues can change by such large dust pollution. The behavior of plant body cells depends upon the chemical properties of dust particles. Chemicals such as lead, iron, compounds of calcium etc. present in dust particles deposits on plant body and thereafter undergo changes with respect change in atmospheric conditions (Gajanan and Sagar, 2013).

Air and dust pollution has major cause to reduce the quality and quantity of food plant leave and tasar silkworm production. In tasar culture, most of the organization / centre has been established near to national or state highway viz., main Institute (Central Tasar Research and Training Institute (CTR&TI), Basic Seed Multiplication and Training Centre (BSM&TC), Regional Sericulture Research Centre (RSRS), Regional Extension Centre (REC) and Pilot Project Centre (PPC). Therefore, tasar production is affected by air and dust pollution. Air pollution which is associated with the primary (i.e. direct) and secondary (i.e. indirect) effects on the insect population especially when the insects involved are phytophagous like the silkworm larvae. Airborne pollutants are directly or indirectly responsible for the toxicological effects and decline in the population of such insects.

Construction of new road or expanding of road is one of the major sour of dust pollution. Gravel and crushed gravel and hard rock aggregates always contain a proportion of fines, and if the material is dry, a fairly heavy dust cloud can be raised when it is mobilized. Road construction dust damage to air quality concentrates in the increase of particulate concentration, especially PM_{2.5} and PM₁₀, and the decrease of atmospheric visibility. Construction dust reflects sunlight away from the Earth with a low thermal admittance, leading to a cooling of the earth surface. Dust pollution is one of the most serious problems which damage to both tasar food plants and silkworm health. Dust pollution may affect photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants in tasar food plants. Visible injury symptoms may occur and generally there is decreased productivity. It also affects the quality and quantity of tasar cocoon and enhances the mortality of tasar silkworm. The main objective of study is to assess the effect of dust pollution on silkworm health at different distance from national highway during rearing periods in both Asan and Arjun plants, primary food plants of tasar silkworm.

Materials and Methods

Description of the Study Area

Study area is situated in the Piska-Nagri, district of Ranchi, Jharkhand state. Lying between 22° 30' and 24° 30' N E Latitude and between 83°22' and 85° 06' E Longitude at an altitude of 651 meters above MSL. This region comes in the 7th (eastern plateau and hill regions) of 15 agro-climatic zones as classified by NARP. The region enjoys a humid to sub-tropical climate and receives a mean annual rainfall of 1323.00 mm in 100 rainy days. Of this, nearly about 85 per cent is received during south - west monsoon (2nd week of June – 1st week of October), 7.78 per cent during North East monsoon (2nd week October – 3rd week of December), 2.87 per cent during winter (January-February) and 7.48 per cent during summer (March - May). The maximum temperature ranges from 29.3 °C to 36.2 °C and the minimum temperature ranges from 4.5 °C to 19.8 °C.

Characteristic properties of soil:

The typical soil of the district is red sedentary. This is an inferior soil and can be used for cultivation of crops like maize, kurthi, kodo etc. In the northern portion of district grey soil is found. This is of alluvial origin and is of heavier texture. It is quite fertile and suitable for the paddy.

Tasar food plants and plot for silkworm rearing

Tasar food plants viz., *Asan Termanalia Tomentosa* & *Arjun Termanalia Arjuna* in plot number 4 and 5 for silkworm rearing

Distance of food plants from road site for experiment

Table 1: Distance of food plants from road site for experiment

Distance	<i>Asan Termanalia Tomentosa</i>	<i>Arjun Termanalia Arjuna</i>
1.	0 meter	0 meter
2.	5 meter	5 meter
3.	10 meter	10 meter
4.	15 meter	15 meter
5.	20 meter	20 meter
6.	25 meter	25 meter
7.	30 meter	30 meter
8.	35 meter	35 meter
9.	40 meter	40 meter
10.	45 meter	45 meter
11.	50 meter	50 meter
12.	55 meter	55 meter
13.	60 meter	60 meter

Survival percentage of tasar silkworm at different distance

Number of larvae and cocoon in Asan and Arun plants were recorded at different distance viz., 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 and 60 meters for assess the effect of dust pollution on silkworm rearing during first crop.

Cocoon weight, shell weight and SR% at different distance

Cocoon weight, Cell weight and SR% were recorded were recorded at different distance viz., 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 and 60 meters for assess the effect of dust pollution on silkworm rearing during first crop.

Reeling parameters

Silk yarn length, silk yarn weight and broken filaments filament length, silk recovery non waste recovery was recorded at different distance viz., 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 and 60 meters for assess the effect of dust pollution on silkworm rearing during first crop.

Results and Discussion

Effect of dust pollution on cocoon production (cocoon/150 larvae) at various distances of tasar food plants from national highway

The effect dust pollution on numbers of cocoon production (cocoon/150 larvae) at different distance from road in tasar food plants are given in table (4.1) and figure number (4.1&4.2). None of the single cocoon was found up to 10 meter in Arjun and 15 meter in Asasn food plants from roadside. These larvae of silkworm started death during first to fourth stage during rearing periods due heavy dust pollution near roadside. Highest cocoon production (35 cocoon/150 larvae) in Arjun and (39 cocoon/150 larvae) was found in highest distance (60 meter distance from roadside) whereas lowest cocoon production was observed (2 cocoon/150 larve) at 15 and 20 meter distance in Arjun plant and (6 cocoon/150 larvae) at 20 meter distance from road in Asan food plan. Similar trend was also observed in Asan food plants. The survival % was less near to roadside and high near highest distance (60 meter). It might be due to heavy dust pollution near roadside areas in tasar food plants.

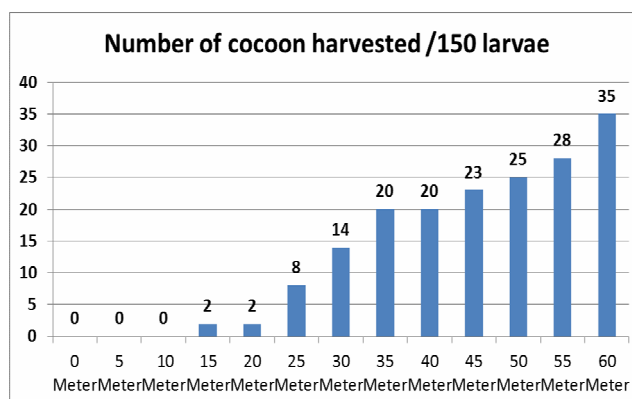


Fig. 4.1 : Effect of dust pollution on cocoon production (cocoon/150 larvae) in Arjun plant from different distance of roadside

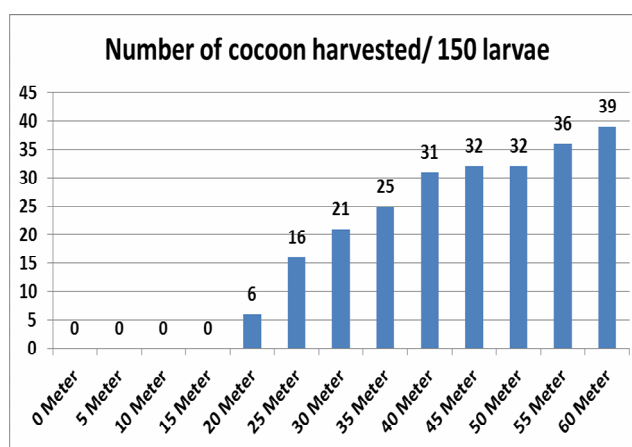


Fig. 4.2 : Effect of dust pollution on cocoon production (cocoon/150 larvae) in Asan plant from different distance of roadside

Effect of dust pollution on cocoon weight (g/cocoon) at various distances from nation highway in tasar food plants

The effect dust pollution on cocoon weight (g/cocoon) at different distance from road in tasar food plants are given in table (4.2) and figure number (4.3&4.4). Not a single cocoon was harvested up to 10 meter from roadside in Arjun plant and 15 meter in Asan plants. It might be due heavy dust pollution near roadside areas. Severity of dust pollution on tasar silkworm was high in Asan plant as compared Arjun plant. It might be due asan leave has wide canopy with rough surface so that it adsorb more dust on surface leaf. Highest cocoon weight (11.96 g/cocoon) was observed in highest distance from road in Arjun plant. Similar result was also observed in Asan plant. Generally cocoon weight (g/cocoon) was high in Asan tree as compare to Arjun tree at all distance from roadside.

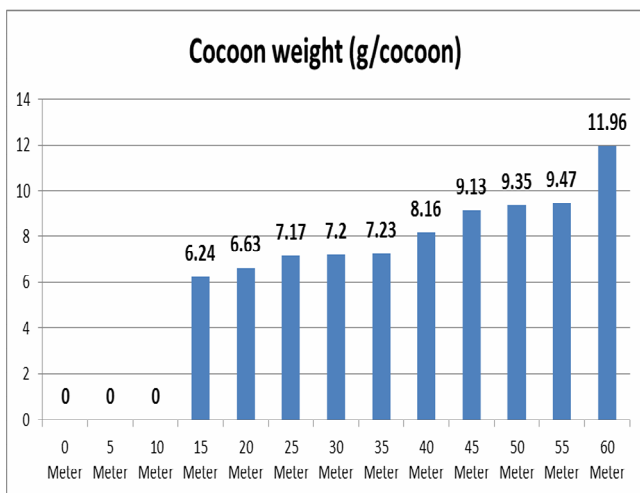


Fig. 4.3 : Effect of dust pollution on cocoon weight (g/cocoon) in Arjun plant from different distance from roadside

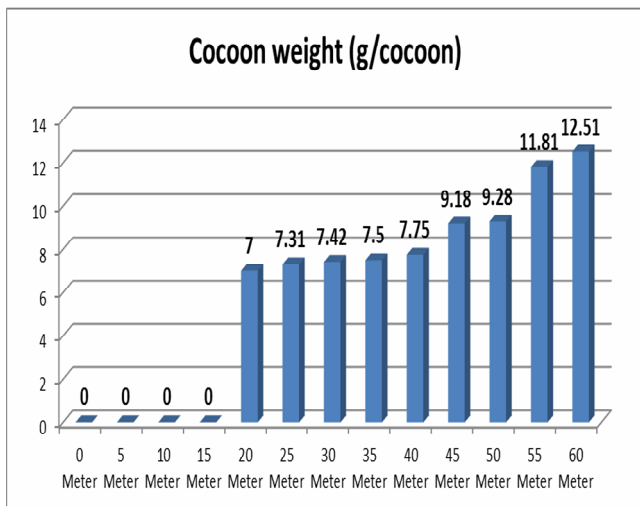


Fig. 4.4 : Effect of dust pollution on cocoon weight (g/cocoon) in Asan plant from different distance of roadside

Effect of dust pollution on shell weight (g/cocoon) at various distances from nation highway in tasar food plants

The effect of dust pollution on shell weight (g/cocoon) at different distance from road in tasar food plants are given in table (4.3) and figure number (4.5&4.6). Not a single cocoon was harvested up to 10 meter from roadside in Arjun plant and 15 meter in Asan plants. Severity of dust pollution on tasar silkworm was high in Asan plant as compared Arjun plant. It might be due asan leaf has wide canopy with rough surface so that it adsorb more dust on surface leaf. Highest shell weight (1.91g/cocoon) was observed in highest distance from road in Arjun plant. Similar result was also observed in Asan plant. Shell weight (g/cocoon) was high in Asan tree as compare to Arjun

tree at all distance from roadside. Generally shell weight were low near to roadside and higher in away from roadside plant. It might be due to heavy dust pollution during construction of national highway.

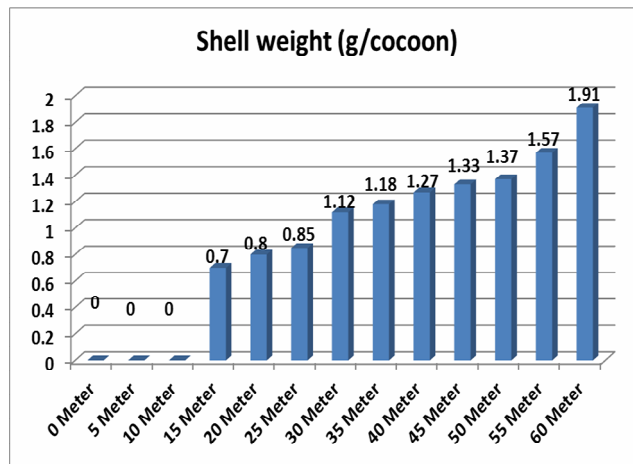


Fig. 4.5 : Effect of dust pollution on shell weight (g/cocoon) in Arjun plant from different distance of roadside

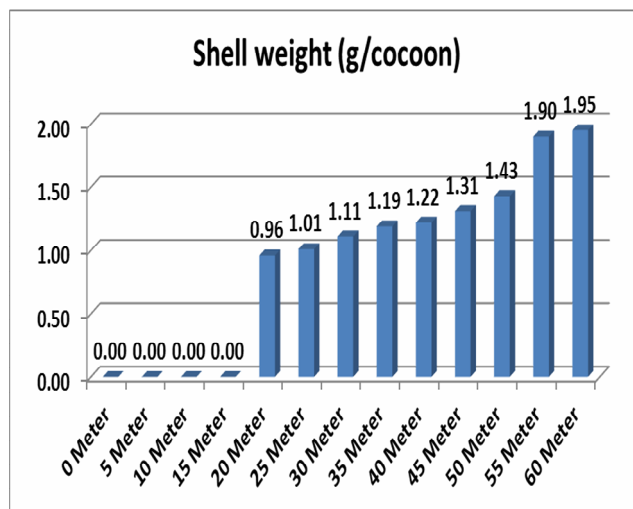


Fig. 4.6 : Effect of dust pollution on cocoon weight (g/cocoon) in Asan plant from different distance of roadside

Effect of dust pollution on SR% at various distances from nation highway in tasar food plants

The effect of dust pollution on SR% at different distance from road in tasar food plants are given in table (4.4) and figure number (4.7 & 4.8). The Highest SR% 16.57 was found at 55 meter distance and lowest SR% is in cocoons of arjun plants at 15 meter distance. Similar trend was also observed SR% in Asan plants. SR% at distance 15 meter to 25 was less in Arjun and 20 -25 meter in Asan whereas SR% was high after 25 meter to 60 meter distance from roadside. It might be due heavy dust and air pollution near roadside areas.

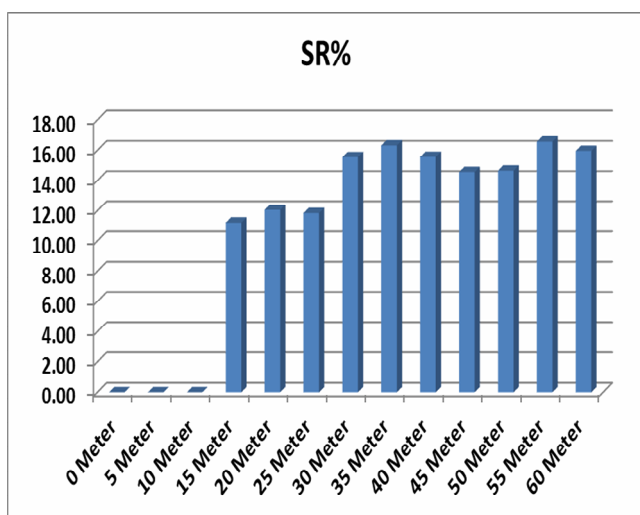


Fig. 4.7 : Effect of dust pollution on SR% at various distances from national highway in Arjun plants

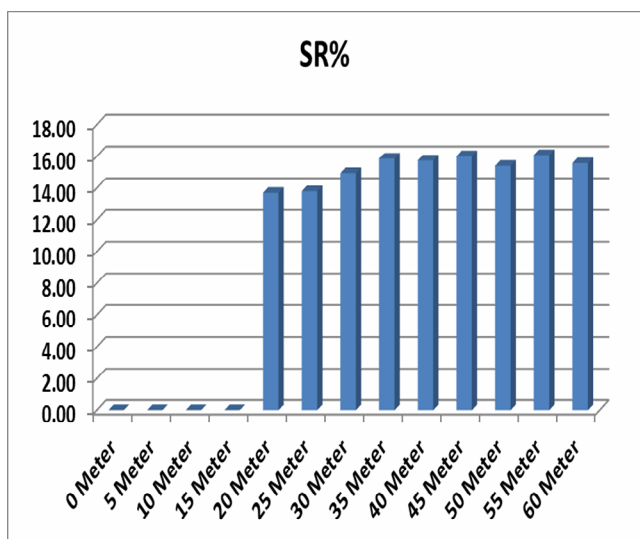


Fig. 4.7 : Effect of dust pollution on SR% at various distances from national highway in Asan plants

Effect of dust pollution on plant leaf (g/leaf) at various distances from nation highway in tasar food plants

The effect dust pollution on plant leaf at different distance from road in tasar food plants are given in table (4.5) and figure number (4.9 & 4.10). Highest dust pollution (dust/leaf) was observed (24g / leaf) near to roadside in Arjun plant whereas lowest dust deposited (5.36 g/leaf) highest distance from roadside. Similar result was also observed in Asan plant. Dust deposition rate in Asan plant was high in arjun tree at all distance from roadside. The dust deposition rate was higher near to roadside and lowest to highest distance from roadside, it might be settling of dust particle is high near to source.

Table 4.5 : Effect of dust pollution on shell weight (g/cocoon) in Arjun plants

Sl. No.	Distance	leaf weight with dust	Leaf weight without dust	Dust weight	Dust (g/leaf)
1	0 Meter	16.22	7.78	1.94	24
2	10 Meter	7.41	3.43	0.84	10.84
3	20 Meter	11.89	5.11	1.28	17
4	30 Meter	5.82	1.97	0.49	7.79
5	40 Meter	8.28	1.42	0.35	9.7
6	50 Meter	6.9	0.86	0.22	7.76
7	60 Meter	4.83	0.53	0.13	5.36

Table 4.6 : Effect of dust pollution on shell weight (g/cocoon) in Asan food plants

Sl. No.	Distance	leaf weight with dust	Leaf weight without dust	Dust weight	Dust (g/leaf)
1	0 Meter	21.46	13.68	3.43	35.14
2	10 Meter	24.41	15.22	3.8	39.63
3	20 Meter	22.53	9.29	2.32	31.82
4	30 Meter	20.94	5.66	1.42	26.6
5	40 Meter	16.22	3.57	0.89	19.79
6	50 Meter	35.07	5.03	1.25	40.1
7	60 Meter	16.03	2.4	0.6	18.43

Effect of dust pollution on cocoon reeling parameters at different distance from road side on tasar food plants

Effect of dust pollution on cocoon reeling parameters at different distance from road side on Asan plants are given in table (4.7) and (4.8). Filament length (m), filament weight and NBFL were very low (near one third) in 20-40 meter distance from roadside arjun plants as compare to control (near dust free plant) in Arjun plant. Similar trend was also observed in Asan food plants. Reeling parameter (filament length, NBFL and filament weight) was low near roadside and high at away from roadside. It might be due to heavy dust and air pollution near to roadside areas.

Table 4.7 : Effect of dust pollution on cocoon reeling parameters at different distance from road side on Arjun plant

Sl. No.	Parameters	Distance (20-40 meter)	Distance (40-60 meter)	Control
1	Shell weight(g)	0.941	1.421	1.99
2	Filament length(m)	401.3	708.1	1146.5
3	Filament weight(g)	0.452	0.823	1.35
4	Freaks	3.8	3.6	3.3
5	NBFL	82.4	155.99	286.77
6	DENIER	10.18	10.6	10.53
7	Waste weight(g)	0.323	0.391	0.4

Table 4.8 : Effect of dust pollution on cocoon reeling parameters at different distance from road side on Asan plant

Sl. No.	Parameters	Distance (20-40 meter)	Distance (40-60 meter)	Control
1	Shell weight(g)	1.231	1.778	1.99
2	Filament length(m)	503.6	802.5	1146.5
3	Filament weight(g)	0.535	0.904	1.35
4	Freaks	4.5	4.2	3.3
5	NBFL	88.83	157.14	286.77
6	DENIER	9.52	10.08	10.53
7	Waste weight(g)	0.401	0.446	0.4

References

- Gajanan, N.S. and Sagar, M.G. (2015). Effects of Dustfall on Vegetation, *International Journal of Science and Research*, **4(7)**, 2184-2188.
- Rai, P.K. (2011a). Dust deposition capacity of certain roadside plants in Aizawl, Mizoram: Implications for environmental geomagnetic studies. In: Recent Advances in Civil Engineering S.B. Dwivedi *et al.* (Eds), 66–73.
- Rai, P.K. (2011b). Biomonitoring of particulates through magnetic properties of road-side plant leaves. In: Tiwari D (ed) Advances in Environmental Chemistry. Excel India Publishers, New Delhi, pp 34–37
- Sharma, H., Jain, V.K. and Khan, Z.H. (2007). Characterization and source identification of polycyclic aromatic hydrocarbons (PAHs) in the urban environment of Delhi. *Chemosphere*, **66**: 302–310.
- Yan-ju, L. and Hui, D. (2008). Variation in air pollution tolerance index of plant near a steel factory: implications for landscape plant species selection for industrial areas. *Environment, Development*, **1**: 24-30.