

STUDY AND CONSERVATION OF HOST FOOD PLANTS OF MUGA SILKWORM, *ANTHRAEA ASSAMENSIS* (HELPER), OF ASSAM

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ABSTRACT

Assam is a treasure house of flora and fauna having tremendous economical value. *Antheraea assamensis* (Muga silkworm) and their host plants are good example of this wealth. Muga silkworm which produces golden silk of high economic value available in Assam especially in Brahmaputra valley. *Antheraea assamensis* (Helper) is a polyphagous insect, hence it thrives on various types of food plants. Lack of scientific knowledge about plants, degradation of environment for various reasons and nonimplementation of proper policy for restoration of the same make most of the food plants vulnerable. In this paper systematic study of some of the food plants of Muga silkworm has been reported. The problems associated with these plants have been discussed and few strategical points have been suggested for conservation of the biodiversity of both flora and fauna.

INTRODUCTION

The north-eastern region of India is one of the focal parts of the world having a rich biodiversity due to its congenial eco-climatic condition and geographical position (Singh & Maheshwari 2003). Destruction of any habitat will mean the disappearance of vast number of species (Raina & Kioko 2000). There are large number of beneficial insects inhabiting this region, which play an important role in the conservation and utilization of biodiversity. Insects are chief consumers of plants as predators. They play a major role in the decay of organic matters and serve as food for other kinds of animals. Wild silk moths are one of them (Frankel 1982, Peigler 1993, Kioko 1998).

The north-eastern region of India is the natural abode of large number of sericogenous insects. The habitat biodiversity of all these sericogenous insects is wealth of ecosystems of this region. Several wild silk moths have been reported from India and out of them four important commercial varieties of silkworm are exploited in this part, i.e. Tasar, Muga, Eri and Mulberry (Rangaswami et al. 1976). The sericogenous Saturniid *Antheraea assamensis* Helfer (chromosome number, $n = 15$) is a monospecies and exclusively confined to the Brahmaputra valley of Assam, India (Chowdhury 1982, Rao 1978) due to its unique ecological niche. It produces golden coloured silk of high economic value.

It is important that this region is the ancestral origin of the wild counterpart and semi domesticated form of muga silkworm (Rangaswami et al. 1976) and as such a large number of muga host plants have been reported so far. The muga silkworm is polyphagous on certain plants as most of the Lepidoptera tend to have a wider range of host plant acceptability (Wasserman & Mitter 1978). The colour morphs and the wild counterparts vary in their phenotypic characters depending upon the host plant selection or seasonal changes. Moreover, according to habitat status the animals may

change their characters. As primary food plants preferred by the silkworm are som (*Persea bombycina*) and soalu (*Litsea monopetela*). Som is naturally abundant in upper Assam (Dibrugarh, Sibsagar, Lakshimpur, Jorhat and Golaghat districts) as well as the large plantations in the forests and hilly regions of lower Assam (Darrang, Kamrup, Karbianglong and Goalpara districts), which is commercially exploited for reeling cocoon production (Chandrasekhar & Thangavelu 1986). Soalu is distributed in the foothills of lower Assam extending up to Garo hill ranges of Meghalaya and is utilized for muga seed production. Moreover, more than 22 plants have been reported which are used as the secondary host plants of muga silkworm rearing. These plants are scattered in forests, wastelands and in some plantation areas of villages. The food plants are found in warm and humid conditions with high rainfall and acidic soils (Singh & Maheshwari 2003). They prefer high iron content in soil. These food plants are naturally abundant in north-eastern India both in plains of Brahmaputra basin and in eastern Himalayan ranges, but all the food plants are not fully exploited commercially due to lack of proper knowledge. Presently, because of deforestation and urbanization, the natural habitat of the wild population of these food plants is shrinking, which requires immediate attention for conservation (Barua et al. 2000, Chowdhury 1982). Few attempts have been made to study the food plants of muga silk. Therefore, this study has been made to find out the distribution and the systematic aspect of host plants of muga silkworm. This will eventually help in proper utilization and conservation of the food plants and will generate the revenue for the muga farmers in this region (Narang & Gupta 1980).

MATERIALS AND METHODS

An intensive survey has been carried out throughout the Assam to study existing status of the host food plants of Muga silk worm (*Antheraea assamensis* Helfer) in different seasons of the year. Plants were tagged, collected and identified following Kanjilal et al. (1992) and compared with standard collection of Herbaria at IASST, Guwahati and Botany Department Herbarium, Gauhati University.

RESULTS

A total number of 24 species of food plants have been categorized as primary host plants and secondary host plants on the basis of the reports from farmers and the literature surveyed. As such som (*Persea bombycina*) and soalu (*Litsea monopetela*) are the primary food plants, and the others are secondary food plants. The list has been given with their taxonomic characters.

The Primary food plants

1. *Persea bombycina* (King ex Hook. f.) Kost (Syn. *Machilus bombycina* King ex Hook. f.)

Family: Lauraceae, **Vernacular name:** Som

Botanical features: The tree is middle sized. Bark is light or dark grey, rough, and young shoots and inflorescence are silky. Leaves are elliptic lanceolate to obovate lanceolate, oblong lanceolate or oblanceolate, acuminate or subacuminate, base cuneate or acute. Panicles are subterminal. Pedicels are long and silky. Flowers about 0.70cm long. Perianth tube obsolete segments oblong or oblong lanceolate. Filaments villous at the base, fruit globose.

It is distributed throughout Assam in natural and cultivated population, ascending to an elevation about 1500 ft.

2. *Litsea monopetela* (Roxb.) Pers (Syn. *Litsea polyantha* Juss.)

Family: Lauraceae, **Vernacular name:** Soalu

Botanical features: Middle sized evergreen tree. Bark is grayish brown, somewhat rough, inside reddish brown. Leaves are broadly elliptic, ovate or obovate, acute or rounded at apex, coriaceous. Lateral nerves are 6-10 on either half, tertiaries scaliform, prominent, base rounded, somewhat oblique, petioles pubescent, entire tomentose beneath. Flower greenish, auxiliary in umbellate silky heads. Perianth is 5 partite, oblong. Stamens 9-12, filaments villous, gland stipitate. Fruits are ovoid, blackish when ripe, supported by persistent perianth and the thickened pedicels.

It is widely distributed all over Assam. The wild population mostly found in the foothill region of entire Assam.

The Secondary food plants

1. *Litsea cubeba* (Lour. Pers) (Syn. *Litsea citrata* Bl.)

Family: Lauraceae, **Vernacular name:** Mezankari

Botanical features: It is small and deciduous tree. The bark is green, warty, blaze yellowish, turning brownish, somewhat mucilaginous. Leaves are lanceolate or narrow ovate-lanceolate, caudate-acuminate membranous bright green above, glaucous beneath. Lateral nerves are 8-13, slender arcuate. Base is oblique acute, petioles slender. Flowers are capitate, umbels solitary or corymb, bracts 4. Peduncle slender, pedicels villous, sepals membranous, obovate, subequal, fruits 0.75 cm across.

Farely common in Jorhat, Sibsagar. It is distributed elevation up to 5500 ft.

2. *Litsea nitida* Roxb. Ex. Wall

Family: Lauraceae, **Vernacular name:** Kothalua

Botanical features: The tree is middle sized and glabrous. Bark is green and rough. Leaves are oblong lanceolate or oblong ovovate, obtuse, subacute, rigidly coriaceous and glabrous. Lateral nerves 7-12 on either half, base is coniate or narrowed, petiole is stout, racemes, glabrous. In male inflorescence peduncles long, slender; bracts unequal, glabrous. Perianth tube turbinate, silky. In female inflorescence peduncles shorter than male, fruits are aromatic, yellowish, ellipsoids, half enclosed in the copular perianth.

It is distributed especially in the districts of Lakhimpur, Sibsagar, Nagaon, Darrang, Goalpara, N.C. Hills and Silchar.

3. *Litsea salicifolia* (Roxb. Ex Nees) Hook. f.

Family: Lauraceae, **Vernacular name:** Dighloti

Botanical features: It is a small shrub type tree. Branches are silky pubescent. Leaves are alternate, elliptic or narrow lanceolate acuminate, cuneate at base, entire, pubescent beneath. Flowers generally greenish yellow. Umbels are 4-6 flowered. Stamens 6-9, filament villous. Fruits are black, ellipsoid.

Scattered distribution, mostly found in Lakshimpur, Dhemaji, Sibsagar, Darrang, Kamrup, Goalpara and Nagaon districts.

4. *Actinodaphne angustifolia* Nees

Family: Lauraceae, **Vernacular name:** Baghnola/Petari-chawa

Botanical features: Large or moderate sized tree. Bark is grayish with white patches or chocklate brown. Blaze is yellowish, turning brown, young part rusty tomentose. Leaves are lanceolate or

elliptic, bluntly acuminate or attenuate, coriaceous. Petiole long. Flowers are shortly peduncled, umbellate, tormenose clusters. Stamens are 6-7, both or inner 2 series glandular. Filaments densely pilose. Fruit globose, sealed on a small cup shaped entire perianth tube.

Distribution is fairly common. Mostly found in Lakshimpur, Karbianglong, N.C. Hills, Silchar, Barpeta, Golaghat, Sibsagar, Jorhat, and Darrang districts.

5. *Actinodaphane obovata* (Nees.) Bl.

Family: Lauraceae, **Vernacular name:** Pati-chanda/Pati-honda/Pajihota

Botanical features: It is large or medium sized evergreen tree. Leaves are broadly ovate-elliptic, shortly acuminate, narrowed down to the base. Flowers are yellow, dioecious, in fasciates on extra axillary racemes. Perianths are silky outside, subequal. Stamens 9 in 3 series, inner most glandular. Staminodes are present in female flowers. Fruits ellipsoid.

It is distributed in the districts of Golaghat, Lakshimpur, Sibsagar, Karbianglong, Silchar and N.C. Hills.

6. *Cinnamomum bejolghota* (Buch. Ham) Sweet (Syn. *Cinnamomum obtusifolium* Roxb. Nees.)

Family: Lauraceae, **Vernacular name:** Pati-honda/Naga-dalchini

Botanical features: It is a large tree. Bark is grey or brownish white, rough, up to 1.5 cm thick, blaze, aromatic, yellowish. Leaves elliptic oblong or elliptic, obtuse, acute or acuminate, glabrous. Based are 3 nerves, petals stout. Panicles large, long, peduncled, subterminal, minutely pubescent, glabrate with age. Pedicels are short. Perianth lobes silky on both surfaces; inner 3 usually villous, all persistent in fruit, elliptic or ovate. Stamens and ovary are sharply pubescent. Fruit ellipsoid or subglobose type seated on the slightly enlarged perianth.

Specially distributed in the districts of Golaghat, Lakshimpur, Sibsagar and Karbianglong

7. *Cinnamomum glaucescens* (Nees.) Hand-Maz (Syn. *C. cecicodaphne* Meissn.)

Family: Lauraceae, **Vernacular name:** Gonsoroi

Botanical features: The tree is large to middle sized. Bark is dark brown or grey furrowed. Blaze brown with darker streaks. But scales broadly ovoid or subaribular imbricate, brown, silky, tormentose; inflorescence and juvenile shoots brown tormentose. Leaves are alternate, variable in size and shape, elliptic, lanceolate, blunt acuminate, caudate, thickly coriaceous, green beneath. Penicles crowded at base of current years shoots. Flowers are densely tormentose, pedicels slightly stouter. Fruit are long, ellipsoid or oblong seated on the perianth cup.

It is fairly distributed throughout Assam and especially distributed in the Indo-Bhutan boarder area.

8. *Cinnamomum tamala* Fr. Nees. (Syn. *C. albiflorum* Nees.)

Family: Lauraceae, **Vernacular name:** Tejpat

Botanical features: It is a small or medium sized branched tree. Bark is rough, dark grey or dark brown. Blaze aromatic, reddish brown. Leaves are alternate, sub-opposite or opposite on the same twig, ovate-oblong or elliptic to oblong-lanceolate, acuminate with the tip, often subfulcate or acute, glabrous. Petiole about 0.75-1.25 cm long. Penicle about as long as the leaves; branches and pedicels grey pubescent; pedicels about 1.50-5.0 cm long. Flowers oblong or elliptic-oblong. Stamens are villous. Ovary is free villous; style glabrous and filiform. Drupe is black when ripe, ovoid, supported by the thickened peduncle and the enlarged truncate toothed base of the perianth. It is distributed

throughout Assam.

9. *Cinnamomum camphora* F. Nees. (Syn. *Laurus camphora* ver. camphor Nees.)

Family: Lauraceae, **Vernacular name:** Karpur/Camphor plant.

Botanical features: It is a small low branched tree with spreading crown. Bark is dark grey, almost black, furrowed, twig glabrous. Leaves are with a pleasant camphoraceous odour, elliptic-lanceolate, ovate or sub-orbicular, acuminate, more or less to the petiole. Base is 3 nerved, petiole about 1.25-3.75 cm long, slender. Flowers are fragrant, pale, yellowish, glabrous panicles, glands of the stamens yellowish. Berry sub-globose, black, seated on the thickened pedicel and cup shaped base of the perianth. Fairly distributed all over Assam.

10. *Magnolia pterocarpa* Roxb. (Syn. *Magnolia sphenocarpa* Roxb.)

Family: Magnoliaceae, **Vernacular name:** Pansopa/Panchopa/Doloi-champa

Botanical features: Green middle sized evergreen tree, and branchlet green and annulate. Bark is grey, rough with warts inside fibrous. Leaves elliptic or obovate vary coriaceous, glabrous. Lateral nerves present 20-25 on either side, base cuneate, petiole flattened above with a narrow V-shaped scar. Flower buds ovoid, with cadous bract, sepals 3, 3 by 2 in. Petals with 6 dull white very fleshy but with a sharp margin, aromatic, stamens numerous with no interval between them, anthers long with purple tips. Stigmas feathery. Seeds orange.

Fairly common in Assam but mostly found in the districts of North Lakshimpur, Silchar and N.C. Hills.

11. *Calastrus hindsii* Benth. (Syn. *Calastrus monosperma sensu* Lawson)

Family: Celastraceae, **Vernacular name:** Bhomloti

Botanical features: It is a large glabrous woody climber, brachlets quadrangular, not lenticelled, hollow tree. Leaves elliptic, oblong or obovate, abruptly and bluntly short acuminate, chartaceous. Lateral nerves present 5-7 on either half, much arched, tertiaries slender, subscaliciform, base sub-cuneate, petiole long. Flowers are whitish, rachis quadrangular; buds globose. Pedicels are long, bracteoles minute, persistent. Calyx is lobed orbicular in buds, slightly elongated in open flowers. Petals long, broadly oblong or obovate-oblong. Anthers are very broad, purplish brown. Dotted style 3 lobbed at the apex, gradually narrowed upward from the ovary. Capsule is long, 3 valved. Seed ellipsoid. It is fairly common throughout Assam.

12. *Ziziphus maritiana* Lam. (Syn. *Ziziphus jujuba* (L.) Gaertn.)

Family: Rhamnaceae, **Vernacular name:** Bogori

Botanical features: It is shrub or small tree; branches tomentose. Leaves are ovate oblong or suborbicular, acute or obtuse, entire or crenate, tomentose beneath, 3 nerves at base. Stipules modified into spin. Flowers are greenish yellow, in axillary fascicled cymes. Calyx glabrous within. Petals clawed. Disk is 10 lobed. Drupes are globose or ellipsoid, orange-red when ripe. Distributed throughout Assam.

13. *Gmelina arborea* Roxb.

Family: Verbenaceae, **Vernacular name:** Gomari

Botanical features: Large sized tree. Leaves are ovate, acute or acuminate, entire, cuneate at base, long petiolate with two basal glands. Flowers are yellow, in axillary or terminal panicles. Calyx is broadly campanulate, 5 toothed. Corolla long, yellow, campanulate, pubescent outside, 2 lipped.

Drupes are obovoid-pyriform, orange yellow when ripe. Distributed throughout Assam.

14. *Michelia champaca* L.

Family: Magnoliaceae, **Vernacular name:** Tita chapa

Botanical features: It is middle sized evergreen tree; bark is ash grey or brownish, rather rough outside. Leaves are lanceolate, sometimes ovate, acuminate, thinly coriaceous, glabrous and more or less shining above; lateral nerves about 16 on either side of the midrib with often a few intermediate ones. Bases gradually cuneate, petiole long. Flowers are axillary, rarely terminal, pale yellow to deep dun yellow, fragrant, buds ovoid. Sepals and petals 15-21, oblong or oblanceolate, gradually narrower towards the centre. Fruits are spike, ovoid or ellipsoid. Distributed all over Assam.

15. *Michelia odoratissima* Nees.

Family: Lauraceae, **Vernacular name:** Kowala

Botanical features: The tree is middle sized. Bark is grey, blaze somewhat granular, soft light or pinkish brown, twigs glabrous. Leaves are crowded at end of the branches, variable in shape, oblanceolate, oblong-lanceolate, elliptic oblong or obovate, shortly acuminate or acute. Base cuneate, acute or obtusely narrowed, main lateral nerves slender, usually 7-13 on either side. Petioles channelled. Panicles subterminal, peduncled, glabrous. Flowers are yellowish green, scented. Perianth is tube obsolete, narrow oblong. Filaments are hairy near the base. Fruit are oblong or ellipsoid, purple and primrose when ripe. Distribution is fairly common. Mostly found in the districts of Sibsagar, Silchar, N.C. Hills.

16. *Michelia oblonga* Wall. ex Hook. f. & Thomas

Family: Magnoliaceae, **Vernacular name:** Bor sopa/kothal sopa/Phul sopa

Botanical features: Large sized tree. Bark is grey, rough and aromatic. Leaves are oblanceolate, sometimes ovate, acuminate, thinly coriaceous. Lateral nerves are 10-12 on either half, base acute, petiole slender. Stipules are narrow-oblong as long as the petiole. Flowers are white, axillary, solitary, short annulate peduncles, elongate ovoid. Sepals and petals are 12 in all, white fading to pale yellow, stamens about 50. Filaments carpals about 40, glabrous, generally 4 ovuled, fruit sessile. Fairly common in evergreen forests excepting Nagaon, Kamrup and Goalpara.

17. *Symplocos grandiflora* Wall. ex A.DC

Family: Symplocaceae, **Vernacular name:** Bhomloti

Botanical features: Large sized tree. Generally bark is plain grey with white patches. Leaves are lanceolate, acuminate, subentire or distantly dentate, rigidly coriaceous, glabrous. Midrib depressed above; lateral nerves 8-10 on either half, prominent beneath subparallel base usually cuneate. Flowers are long racemes; bracts deciduous. Pedicels 0.5 cm, calyx obconic, glabrous, segments 5, triangular ovoid. Corolla glabrous, stamens numerous, fruit, smooth sub cylindrical. Fairly common throughout Assam.

18. *Symplocos paniculata* Miq. (Syn. *Symplocos crataegoides* Buch-Hum. ex D.Don.)

Family: Symplocaceae, **Vernacular name:** Dieng-Jong, Lodhra (Sanskrit)

Botanical feature: It is a large shrub. Bark is light grey, rough, corky, fibrous with deep reticulate furrows. Blaze is yellowish. Leaves are elliptic or ovate-acuminate or acute, sharply glandular serrulate, membranous, almost glabrous above. Lateral nerves present 5-7 on either half, slender, ascend-

ing; tertiaries prominent, transverse, forming parallel pits. Base is cuneate or rounded. Flowers are fragrant, yellowish white, bracts cauducous; pedicels long, filiform. Calyx is tube obconic; segment ciliate. Corolla connate at the base; lobes 5. Stamens numerous. Filaments are connate at the base into 5 bundles. Ovary is 2 celled. Fruits are obliquely ovoid or globose, black when ripe, 1 seeded; embryo curved.

Distributed in the districts of Sibsagar, Lakshimpur, Darrang, Kamrup, Goalpara and bordering area of Garo Hills.

19. *Symplocos ramosissima* Wall. ex G. Don.

Family: Symplocaceae, **Vernacular name:** Lodh

Botanical features: Small tree or shrub. Bark is dark brown, finely smooth, and finely smooth, inside yellowish. Leaves are oblong-lanceolate, serrulate, acuminate, chartaceous. Lateral nerves present 6-9 on either half. Base is connate. Flowers are whitish in lax axillary pedunculate pubescent racemes. Bracts are ovate, pubescent. Pedicels are as long as calyx tube. Calyx tube is villous; segment hairy. Fruit hairy. Many Stamens present. Fruits are brownish, ellipsoid. Fairly common in plains.

20. *Xanthoxylum armatum* DC. (Syn. *Xanthoxylum alatum* Roxb.)

Family: Rutaceae, **Vernacular name:** Tejphal

Botanical features: It is small, aromatic tree or a shrub. Bark grayish brown in old trees with corky furrows. Blaze yellowish, turning blackish brown. Leaves are imparpinate, glabrous with foliaceous wings. Lateral nerves present 10-16 on either half, serrulate or subentire, prominently pellucid punctuate on each serrature and sparsely elsewhere, base more or less oblique, petiole short. Flowers are small, yellowish in lax pyramidal pubescent panicles. Pedicels are short, calyx 6-8, linear, often 3, in each fruit, red size of a peeper corn, compressed, tubercled. Seeds are black, globose, rugose. Distribution is sporadic in all over Assam.

21. *Xanthoxylum rhetsa* (Roxb.) DC.

Family: Rutaceae, **Vernacular name:** Bajjramani

Botanical features: It is a deciduous tree. Bark corky and pale yellow outside. Leaves are peripinnate and periperipinnate. Leaflets present 16-25, opposite, subfalcately oblong or ovate lanceolate. Main lateral nerves present in the larger half up to 22, in the smaller 2 or 3 fewer, almost straight. Flowers are small, light green or pale yellow. Bracts are minute. Pedicels are very short; calyx lobe minute, triangular, acute, petals 4, elliptic or elliptic obovate, valvate, anthers versatile. Ripe carpels are globose, 2 valved. Seeds are solitary, globose, bluish black. Sporadic distribution throughout Assam.

22. *Xanthoxylum limonella* Denst. Alston. (Syn. *Xanthoxylum budrunga* Wall. ex DC.)

Family: Rutaceae, **Vernacular name:** Bajjramani

Botanical features: Evergreen large sized tree. Bark is grey and finely reticulately fissured outside. Leaves are generally imparpinate; rachis sometimes armed. Leaflets 15-21, opposite, oblong-lanceolate, very oblique, caudate, acuminate, distantly crenulate with a large reddish pellucid dot. Main lateral nerves present 20-22 up to the base of the acumen in the larger half, 2-3 fewer in the other half. Flowers are minute peduncles sometimes armed. Petals 4. Sporadic distribution in plains.

DISCUSSION

The existing area under muga silkworm host food plants is estimated around 3100 hectare in Assam accounting over 75% of total area. During the study period 24 plant species, belonging to the different families, were recorded from different parts of Assam. The choice of food plants of muga silkworms is unique because they prefer the allelochemicals such as alkaloids, tannins and terpenoids as well as benzylisoquinoline (Peigler 1989, Geissman et al. 1969).

Sixteen varieties the main food plant of the silkworms, som (*Persea bombycina*), are known to exist (Chowdhury 1982). These are locally known as Naharpotia, Azarpotia, Kothalpotia, Jampotia and Ampatia etc. The primary host tree Som is available naturally all over Assam and its adjoining States because the seeds are usually propagated by fallen excreta of birds with undigested seeds scattered over a wide area. The natural population of Som tree is mostly found in the adjacent hilly regions of Assam. The primary food plant Soalu (*Litsea monopetala*) is mostly utilized for production of seed cocoon purpose. The plant is distributed in plains as well as hills, and the propagation occurs by falling seeds. Although three varieties of 'Soalu' existed in this region (Chowdhury 1982), the Central Muga and Eri Research and Training Institute, Lahdoigorh and Regional Muga Research Station, Boko, Assam have collected and identified and maintained about 10 genotypes of Soalu (Sarmah et al. 2004). Now, both the wild population of primary food plants are facing threat of extinction from their natural habitat due to the environmental degradation and related issues (Gogoi et al. 2004).

The Mezankari (*Litsea cubeba*) is an aromatic plant growing in shady environment of upper Assam and producing glossy white silk (Sarmah et al. 2004). The silk from this tree is priced more than that obtained from other plants. The tree is susceptible to a type of infection of bacteria and other diseases and dies in extreme dry or water logging condition. It can not withstand the strong sun and heavy rainfall. Nowadays there is no regular cultivation of this tree; it grows from seeds carried through the excreta of birds. The seed has a hard coat, therefore, it is highly restricted to the some pockets of Jorhat and Sibsagar districts only. Consequently, the Mezankari silk production has also decreased. So, it is highly recommended for specific breeding programme to conserve the germ plasm and commercial exploitation as mentioned in the conservation strategy. Dighlote (*Litsea salicifolia*) is also ideal and suitable for management of muga silkworm rearing, and controls the pest and predators due to bushy type in nature (Raja Ram et al. 1993). This plant is utilized only in experimental level and not for commercial purposes yet. The other secondary host plant species like Kathalua (*Litsea nitida*), Baghnola (*Actinodaphne angustifolia*), Pati-honda (*Actinodaphne obovata*) and Gonsoroi (*Cinnamomum glaucescens*) are very potential source of food plants of Muga larva but these plants are dominantly wild in nature. Now, due to the shrinkage of the forest land, wild population are becoming low. The spicy Tejpat (*Cinnamomum tamala*) and Karpur plants (*Cinnamomum glaucescens*) are the new sources of host plants but these plants have not reached to farmers yet (Barah et al. 1992, Singh et al. 1999). Gomari (*Gamelina arborea*) is scattered all over Assam and it is widely used as an alternate host plant of Eri silkworm (*Attacus receini*). The Bajramoni (*Xanthoxylum* sp.) are mostly confined in the hilly regions and sporadic in distribution due to the specific habitat type, but these have not been exploited commercially. Bogori (*Ziziphus moritiana*) are common all over the districts of Assam especially in the plains area as well as river banks. It is observed that this food plant generally preferred by the wild Muga silkworms and even Tasar silkworms. On the other hand, the valuable timber plant Chopa (*Michelia* sp.) are generally found in the foothill regions especially Indo-Bhutan, Assam-Arunachal and Assam-Meghalaya border, and

rarely found in the plains. Wild population of silkworms occasionally use these trees. The *Symplocos* sp. are distributed sporadically, and due to the habitat degradation the populations are decreasing. The deciduous Pansopa (*Magnolia pterocarpa*) plants are firmly distributed in the foothills of bordering area and especially found in North Lakshimpur district. The large woody climber Bhomloti (*Calatrus hindsi*) population is also becoming very rare due to the habitat degradation .

It is observed that all the secondary food plants are mostly wild in nature and maximum density is found in the hilly terrain or plains in forest areas. In upper Assam, the wild population of host plants is more compared to the lower Assam area probably due to better agroclimatic conditions and undisturbed habitat. Due to the everincreasing urbanization and lopping of forests have led to gene erosion of many valuable genotypes of various species, hence suitable strategies should be adopted for conservation of gene pool of these natural resources to maintain biodiversity (Chinnaswami 2001).

STRATEGY FOR CONSERVATION

Assam, the original homeland of shimmering golden coloured silk producer, is very rich in floral and faunal biodiversity. The food plant of muga silkworm is also a major component of this wealth. All these play an important role in management of ecosystems of the State. The host plant dominated forests are being depleted continuously due to various reasons and this is a serious threat to the muga industry of Assam. Deforestation due to human interfere, wastes and effluents of industries, pollution from oil and natural gases and insecticides usage in tea gardens are some of the causes for depletion of food plants of *A. assamensis*. The conservation of these plants in different ecological habitats is need of the hour to increase the diversity in the population of *A. assamensis*. The following strategy should be adopted for proper conservation of these plants to restore the precious silk industry of Assam.

1. Germ plasm collection, documentation, evaluation and utilization have to be done in systematic way as per the International Board for Plant Genetic Resources (IBPGR).
2. Specific breeding goal (Oliver 1980) for these plants have to be obtained as has been started for mulberry.
3. The Govt. as well as the concerned authorities should adopt effective control measure to minimize the pollution caused by the industries like oil & natural gas and tea gardens etc.
4. *In situ* conservation of food plants is most important. Shrinkage of food plants growing areas due to human intervention should be stopped by the Govt. enacting legislation. Govt. must bring in force the laws, and violation of the same must be suitably penalized.
5. In Assam, the social relevance of the muga culture is very high, therefore, awareness to the mass people for conservation of these plants is very important, and it can contribute in arresting the decline of biodiversity.

CONCLUSION

This piece of work has been conducted under limited facility and there is ample scope to make an intensive survey work throughout the nook and corner of thick forest areas to explore and proper documentation of food plants of the muga silkworm. Thus, it may be helpful for restoration of wild counterpart of *A. assamensis* in various regions in different seasons. Altogether 24 species of food plants of muga silkworm were recorded from Assam. Rearing performance on these plants should be done in a systematic way to fix the yield parameters. The food plants of muga silkworm are grouped

into primary and secondary food plants. The future of muga silkworms is dependent on their food plants, hence it becomes our prime thrust to protect these plant species not only to protect the muga silk worms, but also to save our rich natural biodiversity from further denudation.

ACKNOWLEDGEMENT

The authors are thankful to the authorities of Botany Department, Gauhati University and IASST for providing access to the herbarium facilities.

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