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Destructive Cecidomyids (Diptera: Cecidomyidae) of Forest Trees of Western Ghats (Maharashtra), India

KEYWORDS

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ABSTRACT *Western Ghats is among 18 hot spots of the world for biodiversity conservation and protection. Pests, diseases and fire are worst enemies of forestry. Out of which insect pests rank first in causing damage to forest trees. Cecidomyids (Diptera: Cecidomyidae) cause varieties of galls to forest flora and affect the growth and health of the trees seriously. Therefore, in present study destructive gall forming cecidomyids and types of galls formed on plants have been studied. In all, 27 species of forest plants species have been affected by 23 species of cecidomyids belonging to genera Asphondylia, Ametrodiplosis, Cecidomyiella, Contarinia, Cystiphora, Dasinura, Horidiplosis, Gephyraulus, Lasioptera, Pipaldiplosis, Procontarnia, Schizomyia and Silvestrivola. Leaf and stem galls were abundant and flower galls were rare in the region. The gall chemicals have industrial and medicinal value hence, this work will add great relevance as baseline data.*

INTRODUCTION

There are number of insects which live in the tissues of plants and those activities produce an alteration of the structure of the plant, an unusual growth of tissue taking place, leading to the formation of a gall. As a rule, the connected insect is in the gall, not necessarily in the fully developed gall but in it at some stage of growth; put very broadly, the parent or the actual insect stimulates the tissues to an abnormal growth in which the gall insect lives. The precise nature of this stimulus is not known for many insects but, may be either poison or some agents introduced by the insects when laying eggs or it may be a chemical or mechanical stimulus produced by larval gall insect inside the tissues. The gall products in the form of chemicals have great importance in leather industry, medical science and pest management strategies. Therefore, several workers (Lefroy & Howlett, 1909; Foster, 1934; Bousen & Jensen, 1948; Barnes, 1951; Mani, 1973, 2000; Skuhrava, 1983; Grover, 1988; Isaev et al., 1988; Yoganarasimhan, 2000; Gagane, 2004; Krishnan et al., 2011, etc.) worked on plant galls and gall forming insects in India and abroad. Western Ghats is among 18 hot spots of the world for protection and conservation of biodiversity. Therefore, present work was carried out for recording the index of Cecidomyids and gall forming plants.

MATERIALS AND METHODS

Gall forming flora in forest ecosystem was selected in western Ghats of Maharashtra and observations on formation of galls on leaves, flowers and stems have been taken weekly during the years 2012-2013. After noting galls on the plant, the gall formed areas of the plant were covered with finely perforated plastic bags to monitor the emergence of the gall insects. Many times, a twig of 1 foot long containing galls have been collected and kept in the laboratory deeping the cut end of twig in water for emergence of gall insects. Such twigs were reared in glass cage 25 × 25 × 25cm under control conditions (27 ± 2° C, 65-70 relative humidity, 12 hr photoperiod). Cross sections of gall also been taken for collection of gall insects and further for their identification. Simultaneously, types of gall have also been detected by taking into account of their shape, size, color, features, etc. Sufficient numbers of gall insects were and later, plants, galls and gall insects were identified by consulting appropriate literature cited in references.

RESULTS

Results recorded in table 1 indicated by Cecidomyid insects. In all, 23 species of Cecidomyids belonging to the genera Asphondylia, Ametrodiplosis, Cecidomyiella, Contarinia, Cystiphora, Dasinura, Horidiplosis, Gephyraulus, Lasioptera, Pipaldiplosis, Procontarinia, Schizomyia and Silvestriola have been reported in addition to 8 unidentified cecidomyids. 9 galls were formed on leaves, 8 galls were on stems and 1 was on flower by cecidomyids. In all cases, the plants have been weakened by the galls and by the gall forming insects. The gall types observed on plants are recorded in table 1. Leaf galls were mostly adjacent to midribs. In compound gall more than one larva of gall insect have been noted. The stem galls were subglobose or ovoid or fusiform, glabrous, grayish, hard, woody indehiscent, etc. On a single leaf of Mango, Mangifera indica about 8 galls have been recorded. As much as 12 galls have been noted on the twig of 1 foot length.

DISCUSSION

The belief that certain insects secret some type of substance into plants which stimulates them to produce a gall is not new. The Indian entomologist Malpighi (1625-1694) was probably the first to develop this concept. According to Cockerell (1890) the formation of gall is the result of a specific reaction of the plant to the attack of a Cecidozoan to counteract its harmful effects. While, Kuster (1911) suggested that the plant produces the gall mainly not to support the interest of the Cecidozoan, envisioning primarily a struggle of resistance between the plant and the Cecidozoan. According some workers (Boysen-Jensen, 1952; Godanova, 1956; etc.) the formation of galls involves two processes that are closely linked with each other, the capacity of substances of the larva and the formation of galls due to its influence. Godanova (1956) says that during gall formation immediate contact between the living larvae and the plant tissue is absolutely necessary, since death of the larva before completion of the gall prevents the development of the gall at the point.

According to Mani (1934) at least 11 species of gall midges were known to induce different types of galls only on

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mango. In the present study, 8 species of Cecidomyids were involved in formation of galls on plants. Differences in gall forms can only be described to specific pattern of plant reaction to the nature and chemistry of larval secretion. Mani (1973) described 22 different galls on several species of Acasia and points out that no other plants in India is better known for its more complex. Information of bivalve galls, the plant sustains no injury. It has been shown that osmotic pressure is a factor affecting sclerotic differentiation. The larva laying in between the leaflets feed by extra intestinal digestion and absorbs nutrition from the host tissue using the force of osmotic diffusion (Grover, 1988).

The galls on the shoot axis grow so intensely that even flower and fruit formation are affected. In some instances galls are visible on small stunted fruits and sometimes the pedicels of the flowers are badly damaged. Galls on shoot axis are subglobose or sub conical and cortical, rarely free and solitary and mainly develop in a linear spiral series or into irregular, cortical, often extensive, agglomerate globose or fusiform, multilocular, solid, tuberculate indehiscent, persistent swelling on tender branches (Grover, 1988). According to him stem galls on Coccinia indica W. & A. were dark green, regular, ovoid, fusiform or moniliform, solid and fleshy when young but, later became apple-green and hard. Further he stated that larvae pupated in galls. As regards to flower galls, the infested buds failed to open and ultimately dropped down. Otherwise projecting petals constitute a good character for identification of species. The Cecidomyids laid their eggs in the folds between sepals and petals and on hatching, the larvae entered the floral tissue of plant. This was noted by Grover (1988) in Mangifera indica (L.) since the larvae feed on the sap of vital internal organs of the flowers which resulted in arrested of growth of bud flowers. According to Krishnan et al., (2011) many galls like Folia blister like mites on Prosopis spicigera, Canthium parviflorum and Cancerous persica and Terminalia chebula were extensively distributed on almost all forests. The Psyllid gall on Alstonia scholaris was also a common gall in forests. In the present study only one Cecidomyid galls have been reported and 27 species plants were infected by Cecidomyid galls in forests of western Maharashtra. Finally it is concluded that the galls are good source of important chemicals, may be used in industry and Medicine and have also aesthetic value for advance life of humans. Therefore, galls and gall insects are to be studied on large scale with respect to their diversity and utilization of them in various fields of applied sciences. The present work will add great relevance forming base line data of the region.

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Table-1 Gall forming insects, plants and their features.

Sr. No.	Insect species	Host plants	Gall features
1.	Dasineura gossypii Felt.	Abutilon indicum (L.) Sweet (Malvaceae)	Rinden -Shoot axis gall formed on stem
2.	Contarinia bivalviae (Rao)	Acasia caesia W. & A. (Mimosaceae)	Form Sea-Urchin gall on leaf
3.	Schizomyia orientalis Grover	Acasia leucophloea (Roxb.) wild (Mimosaceae)	Legumi form gall formed on stem
4.	Asphondylia digerae Mani.	Achyranthes aspera L. (Amaranthaceae)	Form vein spindle gall on leaf & vein
5.	Punarnovomyia boerhaaviaefoliae Mani.	Boerhavi diffusa L. (Nyctaginaceae)	Form foliar bud gall
6.	Cecidomyiella crataevae Mani.	Cadaba fruiticosa L. Druce. (Capparaceae)	Form leaf fold covering growth gall to veins and leaves
7.	Unknown Cecidomyid	Canthium rheedi DC (Rubiaceae)	Form symmetrical stem gall
8.	Unknown Cecidomyid	Cassine glauca (Rott.) Kuntz. (Celastraceae)	Form rinden gall to stem
9.	Unknown Cecidomyid	Cinnamomum verum Pres. (Lauraceae)	Form spindle gall to stem
10.	Schizomyia cocculi Mani.	Cocculus hirsutus L. Diels. (Meninspermaceae)	Form amorphous gall on flower
11.	Unknown Cecidomyid	Connarus wighti Hook F. (Connaraceae)	Form twin botton gall on leaf
12.	Unknown cecidomyid	Crotalaria sp. (Papilionaceae)	Form agglomerate rinden gall on stem
13.	Lasioptera cephalandre (Mani)	Ctenolepis longifolia Clarke. (Cucurbitaceae)	Form fusiform stem gall
14.	Unknown Cecidomyid	Eucalyptus globules Labill. (Myrtaceae)	Moniliform rinden gall formed on stem, petiole & leaf
15.	Pipaldiplosis heterofila Mani	Ficus religiosa L. (Moraceae)	Form spindle vein gall on vein
16.	Horidiplosis orientalis (Grover)	Ficus glomerata Roxb. (Moraceae)	Form complex gall on leaf
17.	Asphondylia morindae Mani.	Glycosmis pentaphylla DC (Rutaceae)	Form elliptical eruption gall on leaf
18.	Unknown Cecidomyid	Harpullia arborea Radik (Sapindaceae)	Form club shaped pouch gall on leaf
19.	Dasineura sp.	Holigarna arnottiana Hook. F. (Anacardiaceae)	Formed kammer gall on leaf

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20.	Contarinia maculipennis Felt	Jasminum malbaricum Wight (Oleaceae)	Formed pink cushion gall on leaf
21.	Gephyraulus indica (G. & P.)	Lannea coromandelica Merr. (Anacrdiaceae)	Form shaeroidal vein- all on leaf
22.	Asphondylia sp.	Psychotria sp. (Rubiaceae)	Form copular perfoliate gall on leaf
23.	Unknown Cecidomyid	Terminalia chebula Retz. (Combretaceae)	Form perfoliate pallet gall on leaf
24.	Ametrodiplosis sp.	Tinospora cordofolia Hook. F. & Thoms. (Menispermaceae)	Form terminal bud gall on stem
25.	Cystiphora taraxaci (Kieffer)	Vernonia gossypina Gamble (Asteracae)	Form cotton ball gall on leaf
26.	Silvestriola spatulata G. & B.	Ziziphus xylopyrus Willd. (Rhamnaceae)	Form cover cone gall on leaf
27.	Silvestriola jujubae Chandra	Ziziphus jujuba (Rhamnaceae)	Form compound gall on stem
28.	Dasineura amaramanarae Grover. .	Mangifera indica L. (Anacardiaceae)	Form leaf gall
29.	Gephyraulus mangiferae Felt	Mangifera indica L. (Anacardiaceae	Form leaf gall
30.	Lasioptera mangiflorae (Grover)	Mangifera indica L. (Anacardiaceae)	Form leaf gall
31.	Procontarinia mangiferae (Felt)	Mangifera indica L. (Anacardiaceae)	Form leaf gall

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