A SURVEY ON INSECT GALL DIVERSITY AT MALAPPURAM DISTRICT, KERALA

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ABSTRACT

A study investigated to explore the distribution of insect gall in thirteen different areas at Malappuram district, Kerala. The study was carried out for a period of 6 months from October 2020 to March 2021. Followed by observation the possible galls were photographed. These galls bearing plant parts were randomly collected from these study areas and identified the gall bearing plants and gall with the help of a taxonomist. Twenty seven morphotypes of galls in 18 plant species from 13 families were reported. Most number of galls found in the family Fabaceae and Anacardiaceae (4) 76followed by Combretaceae and Lamiaceae (3). Among the 27 galls, 21 are leaf bearing gall, 5 are stem bearing gall and the rarely occurring ovary gall is only one. In this study, Dipera (20) induces maximum number of galls followed by Hemiptera (5) and Hymenoptera (1). This study also reveals that most abundant gall found in leaves followed by stem in Malabar region.

INTRODUCTION

Galls are the pathologically developed cells, tissues or organs of plants. It has resins mostly by hypertrophy that means overgrowth and hyperplasy means excessive cell division, usually under the influence of parasitic organisms. The growth represents the attack of foreign organism to the plant organ but often related in some way to feeding activity and nutritional physiology of the organism. In this project focus on a survey of diversity of insect galls in Malappuram district.

OBJECTIVES OF THE STUDY

1. To study the diversity of insect induced galls in Malappuram District.
2. To construct taxonomic keys for gall identification.

METHODOLOGY

The specimens were randomly collected from different areas of Malappuram district. The district is located at 75°E-77°E longitude and 10°N -12°N latitude on the geographical map.

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Similar to other parts of Kerala, Malappuram also has a coastal area (lowland) bounded by Arabian sea on the west, a midland at the centre, and a hilly area (highland), bounded by western Ghats on the east. Malappuram spread over an area of 58.20 km^2 (22.47sq mi). The high ranges on the eastern border of district forms a continuous of the Nilgiri mountain ranges of Western ghats, which is also shared by the neighbouring Nilgiris district of Tamil Nadu. A portion of the Nilgiri biosphere reserve lies in Nilambur taluk of Malappuram district. The midland area of the district is also characterised by several undulating smaller hills, which gently slope towards west. The coastal taluks contains coconut fringed sandy beaches, mangroves, estuaries, back waters, kole wetlands and canals. We randomly collected specimen from different areas of Malappuram districts. That mainly include Nilambur, Manjeri, Thenhipalam, Vazhakkad, Vadakkummala. Nilambur is the largest forest area in Malappuram district. Manjeri is a major town and muncipality in Malappuram district. Vadakkummala is also a forest area. Vazhakkad is a village located on the banks of River chaliyar. Thenhipalam is situated in the north -west region of Malappuram.

Intensely hot climate characterizes the summer season in Malappuram district. Like all other parts of Kerala, summer begins in Malappuram from the month of March and is extended till the arrival of monsoons in late May. Months of April and May are the hottest part of the year. Monsoon showers hit Malappuram from the month of June and the region enjoys heavy rainfall for almost four full months till September. January marks the beginning of winter and the mild climate is continued till the month of February. The major forest area is concentrated in Nilambur, Wandoor blocks and Melattur in the Western ghats. Of the forest 80 % is deciduous and the rest is evergreen. Trees are dominant in forest area of Malappuram such as thak, rubber, mahagani etc. Riparian flora are also a major part in Malappuram. The present study carried out from October 2020 to March 2021 in randomly selected areas in Malappuram.

1. Kottakal
2. Vazhakkad
3. Poothavanam
4. Manjeri
5. Wandoor
6. Nilambur
7. Thenhipalam
8. Pathappiriyam
9. Edavanna
10. Vadakummala
11. Chengara
12. Pulligottupuram
13. Kongamala

METHODOLOY FOR OBJECTIVE 1

The plant galls collected along with some part of plant organ were collected directly from the field and stored in ziplock polythene bag. Pertinent details such as the binomials of the host plant species and other relevant plant data were recorded with the help of a botanical taxonomist. This set up was maintained till the gall dried off or inducing insect emerge out.

METHODOLOGY FOR OBJECTIVE 2

The taxonomic keys are constructed on the basis of different characters of gall. The various features of collected galls were recorded. At first we note down the morphology of gall that include shape, size, colour, location, number etc. Then each gall grouped on the basis of host plant's family. After that we construct key by note down the contrasting characters of gall under each host family.

RESULT

Diversity of Insect Gall

I have collected 27 galls from this study. These are included in different 13 plant family. Gall were randomly collected from different localities of Malappuram district. Most number of galls found in the family Fabaceae and Anacardiaceae. However, in this study all the galls in the Anacardiaceae were reported to be *Mangifera indica*. In case Fabaceae each gall present in different host plant, and the least number galls found in Apocyanaceae, Moraceae, Sapotaceae, Cucurbitaceae, Lauraceae and Phyllanthacae (table1). Galls generally differ in their colour, shape, size and induced part of plant. The largest gall in my study was reported in the plant *Mallotus philipensis.* From this study galls most commonly seen in leaf of the induced plant and rarely seen in ovary gall (figure1), that ovary gall is seen in *Pongamia pinnata.* Stem galls are rare when compared to leaf gall, that stem galls found in Piperaceae, Cucurbitaceae, Phyllanthaceae, Laminaceae and Fabaceae families. The largest stem gall among this families seen in *Tectona grandis*. Among the 27 galls, 21 are leaf bearing gall, 5 are stem bearing gall and the rarely occurring ovary gall is only one.

Incest galls induced by wide variety of insect inducers in our biodiversity. We got four types of inducing orders, that are Diptera, Hymenoptera, Hemiptera and Lepidoptera. Most number of galls induced by Diptera and the least number are Lepidoptera and Hymenoptera. What I observed was that in my study area 20 galls were induced by Diptera, 5 galls were induced by Hemiptera, one each by Lepidoptera and Hymenoptera. In terms of the family

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of host plants, the most galls are found Fabaceae and Anacardiaceae. The later are more common in Combretaceae, Lamiaceae, Oleaceae. In the family Fabaceae only five galls were identified, three of which were leaf galls each with a stem gall and ovary galls. This family includes such as *Acacia cassia, Erithrina variegata, Pongamia pinnata* and *Xylia xylorapa.* Among the insect produced by galls in this host family, three are Diptera and two are Hymenoptera.

In the family Combretaceae, only three galls were identified, all of them are leaf gall. This family includes plants such as *Getonia floribunda*, *Terminalia arjuana* and *Terminalia paniculata.*

Among the insect produced by galls in the host family, two are Hemiptera and one is Diptera. In the family Ancardiaceae, only four galls were identified, all of them are leaf galls. However, in this study all the galls in the Anacardiaceae were reported to be *Mangifera indica*. Among the insects produced by galls in the host family, all are Diptera.

In the family Euphorbiaceae, only two galls were identified, all of them are leaf galls. This family includes plants such as *Macaranga petata* and *Mallotus philipensis.* Among the insect produced by galls in this host family one is Diptera and another is Hemiptera.

From the family Oleaceae, three galls were identified, all of them are leaf galls. These all galls are present in *Chionthes malaelengi.* All inducers are Diptera. Three galls were reported in family Laminaceae. Two are leaf gall and one is stem gall among them. All of the gall induced by Dipterans in same plant *Tectona grandis.* One leaf gall and one stem gall reported in *Peper nigrum*, the family Piperaceae. All this galls induced by Diptera. Its stem gall rare in nature.

Only one gall found in each family of Phyllanthaceae, Lauraceae, Cucurbitaceae, Sapotaceae, Moraceae and Apocyanaceae. Of these, three were induced by diptera, two by Hemiptera and one by lepidioptera. Stem gall is found in *Phyllanthus emblica,* which belongs to the Phyllanthaceae family. *Cinnamomum malabatrum* belongs to family Lauraceae, Coccinia indica belongs to Cucurbitaceae, Mimosops elengi, Ficus recemose belong to Moraceae and Alstonia scholaris belongs to Apocyanaceae.

Table 1: list of insect induced plant galls found in Malappuram district

Gall No	Family of Host	Order of Gall Inducing Insects	Gall Nearing Organ	Host Plant	Collection Site
1	Fabaceae	Diptera	Leaf	*Acacia cassia*	Vadakkummala
2	Fabaceae	Hymenoptera	Stem, leaf	*Erythrina variegate*	Edavanna
3	Fabaceae	Diptera	Ovary gall	*Pongamia pinnata*	Nilambur
4	Fabaceae	Diptera	Leaf gall	*Xylia xylocarpa*	Vadakkummala
5	Combretaceae	Diptera	Leaf gall	*Gatonia floribunda*	Manjeri, Nilambur, Vadakkummala
6	Combretaceae	Hemiptera	Leaf gall	*Terminalia arjuana*	Vadakkummala

Gall No	Family of Host	Order of Gall Inducing Insects	Gall Nearing Organ	Host Plant	Collection Site
7	Combretaceae	Hemiptera	Leaf gall	*Terminalia paniculata*	Vadakkummala, Pulingottpuram
8	Euphorbiaceae	Diptera	Leaf gall	*Macaranga petata*	Thenhippalam, Vadakkummala
9	Euphorbiaceae	Hemiptera	Leaf gall	*Mallotus philipensis*	Vadakkum mala
10	Anacardiaceae	Diptera	Leaf gall	*Mangifera indica*	Vadakkummala, Kottakkal
11	Anacardiaceae	Diptera	Leaf gall	*Mangifera indica*	Vadakkummala, Kongamala
12	Anacardiaceae	Diptera	Leaf gall	*Mangifera indica*	Vadakkummala, Kottakkal
13	Anacardiaceae	Diptera	Leaf gal	*Mangifera indica*	Vazhakkad, Vadakummala
14	Oleaceae	Diptera	Leaf gall	*Chionthes malaelengi*	Kongamala, Vdakkummala
15	Oleaceae	Diptera	Leaf gall	*Chionthes malaelongi*	Vadakkummala
16	Oleaceae	Diptera	Leaf gall	*Chionthes malaelongi*	Kongamala
17	Apocyanaceae	Hemiptera	Leaf gall	*Alstonia scholans*	Thenhippalam, Manjeri
18	Moraceae	Hemiptera	Leaf gall	*Ficus racemose*	Nilambur, Manjeri, Kottakkal
19	Sapotaceae	Diptera	Leaf gall	*Mimosops elengi*	Chengara, Vadakkummala
20	Piperaceae	Diptera	Leaf gall	*Peper nigrum*	Vadakkummala, Vazhakkad
21	Piperaceae	Diptera	Stem gall	*Peper nigrum*	Vadakkummala
22	Lamiaceae	Diptera	Stem gall	*Tectona grandis*	Manjeri
23	Lamiaceae	Diptera	Leaf gall	*Tectona grandis*	Manjeri, Chengara, Vdakkummala, Pathappiriyam
24	Lamiaceae	Diptera	Leaf gall	*Tectona grandis*	Vadakkummala, Manjeri, Chengara
25	Cucurbitaceae	Diptera	Stem gall	*Coccinia indica*	Vazhakkad, Wandoor
26	Lauraceae	Diptera	Leaf gall	*Cinnamomum malabatrum*	Nilambur, Wandoor
27	Phyllanthaceae	Lepidoptera	Stem gall	*Phyllanthus emblica*	Vadakkummala, Poonthavanam
27	Phyllanthaceae	Lepidoptera	Stem gall	*Phyllanthus emblica*	Vadakkummala, Poonthavanam

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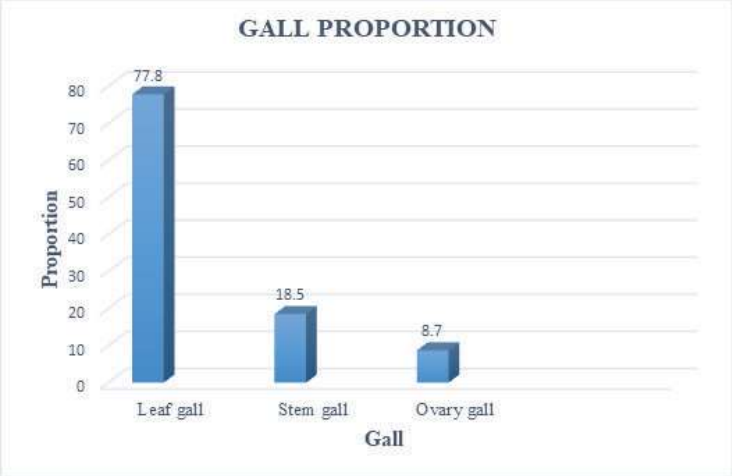

Figure 1: Proportion of type of galls from Malappuram district.

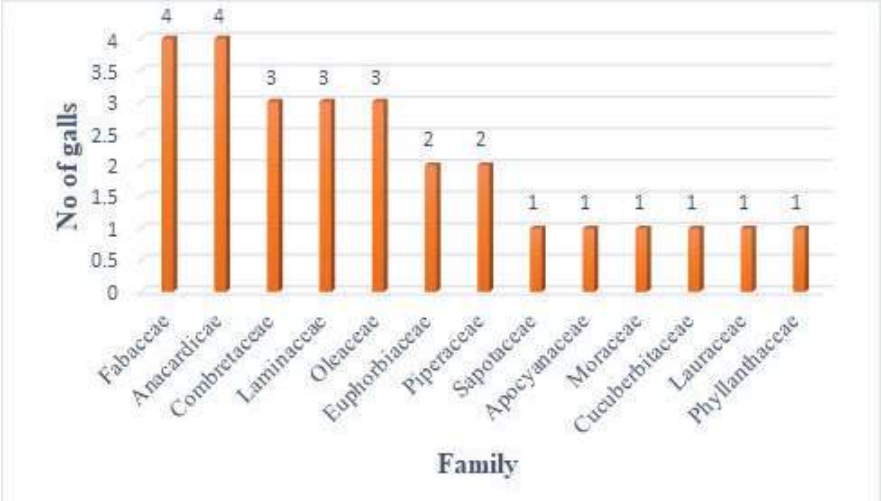

Figure 2: number of induced plant family in Malppuram district

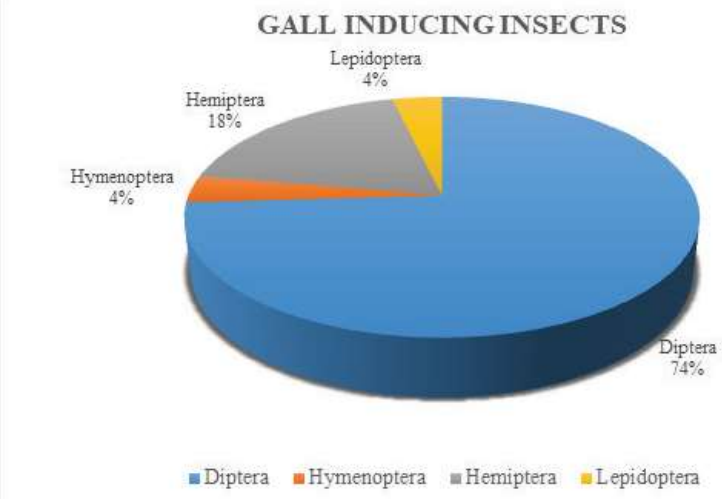

Figure 3: Proportion of order of insect induced gall in Malappuram

DISCUSSION

In my study the distribution of insect induced gall in Malappuram district. Twenty seven recorded gall were not considered to be threatened or off rare occurrence. These twenty seven galls belongs to thirteen host family. These twenty seven gall induced by mainly four order of insects, that are Diptera, Hymneoptera, Hemiptera and Lepidoptera. Largest gall among the twenty seven gall is Malotus phillipensis. Galls are different in their shape, size, colour, position and location of the host plants. Large sized brownish orange colour gall is seen in Ficus racemose.

According to Saleem and M.Nasar (2015), 69 percentage of galls collected during this study occurred on lives and 28 percentage on stem. That means the most abundant gall founding in leaf and followed by stem in Malabar region. I agree with this concept on the basis of my observation. 77.8 percentage leaf gall and 18.5 percentage stem gall I was able to see from this study area. Therefore I observed large number of galls seen on leaves in my study area.

This survey indicate that the Fabaceae included maximum number of galls bearing plants and similar studies reported that the greatest bulk of gall from India occur on plants of natural order Leguminoceae (MS. Mani. 1973). Therefore the Fabaceae family has greatest influenced gall diversity in this area of study.

Also my study showed diptera was most gall inducers. Similar study reported that the result of the study gives the dipterans are one of the most common gall inducers done by Aneesa and Roopavathy (2019). From their study it indicates Diptera induced 41 percentage, 20 percentage induced Hemiptera and Hymenoptera and Lepidoptera occurred in same percentage. Similar result obtained from my study too. From table most number of inducers of galls is diptera (74%) then followed by Hemiptera (18%) and finally equally occuring (4%) Hymenoptera and Lepidoptera. Dicotyledonae are the most susceptible hosts for a majority of gall inducing insect (Mani 2000). This result is also match with my study. Only Dicotyledonae bearing galls obtained from the Malappuram bioregion. That means the monocoteledonae inducing gall is very rare in nature. Galls on ovary or flower inflorescence were very rare (grahp). Two hairy leaf gall were reported in this study. That induced in Macaranga petata and Tectona grandis. Even galls induced in tender leaves of plant such as Mangifera indica (pic).

Two different types of galls were reported in Malappuram bioregion. This result match with the observation of Saleem and Naser (2015) in Malapuram, four different kinds of galls induced on species of terminalia.

Generally gall -inducing insects belonging to specific natural orders and genera induce gall that are similar in size, shape, structure (Saleem and Naser 2015). In this study too, we have found that diptera on Mangifera indica and Chionthes malaelengi induce gall appeared similar in nature.

We got different types gall in Malappuram bioregion that are globoid, conical, discoid, fusiform and hairy. This result also reported in Naser and Saleem (2015). Study that is the gall of Malabar were morphologically variable: globoid, conical, discoidal and fusiform. Many of them were either hairy or spiny. Possible, the hairiness and spines ‘protect’ the

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gall inducing agent against other biotic factors. Diversity in gall morphology, such as the presence of spines in the stem galls on of a lindleyana, hairs in the leaf galls of Tectona grandis and Strobilanthes heyneanus, minght be the result of selection pressure imposed by natural enemies (Naser and Saleem 2015). This study gives a detailed information about insect induced gall and their host plant in Malappuram bioregion.

CONCLUSION

This study is about a survey on insect gall diversity in Malappuram district, Kerala. 27 galls were reported in this study 20 is Diptera inducing galls, five Hemiptera and one in each Hymenoptera and Lepidoptera. From this study Diptera in 74%, Hemiptera 18% and 4% in each Lepidoptera and Hymenoptera. This indicates that most gall inducing insect is belongs order Diptera and least in both Lepidoptera and Hymenoptera. The large sized gall found in this study is Mallotus philipensis. In Malappuram region the galls are different in their shape, size, colour and position. Ficus racemose induced gall is a brownish orange colour that comparatively large in size. Large sized stem gall is induced in phyllanthus emblica. More than one gall seen in same host plant such as Mangifera indica, Chionthes malaelengi, Peper nigrum and Tectona grandis. Result from this study is showed that most abundant gall in Malappuram district is leaf gall. Followed by stem and rarely occuring is ovary gall. This ovary gall induced in Pongamia pinnata. Getonia floribunda and Tectona grandis inducing galls are common in Malappuram district. Stem galls were almost rare when compared to leaf gall.

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