

MIDGE GALLS (DIPTERA : CECIDOMYIIDAE) OF ANDAMAN ISLANDS, INDIA*

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INTRODUCTION

Plant galls are very familiar objects of Natural history. They are so conspicuous in shape and numerous in sort, can easily be found outdoors not only by entomologist, botanist or naturalist but also have attracted the attention of ethnologists as well. Since, plant galls have acquired the place in human ornamentation imparting ethnobotanical significance (Berlin and Prance, 1978).

Galls or tumours are abnormal growths on plants developing as a result of the nutritional dependence of microbes like viruses or mycoplasma like organisms, bacteria and fungi; animals such as nematodes, insects and mites. Of these, the range and amplitude in form and structural specialization are more distinct and marked among galls induced by insects than those by other cecidogenous organisms (Raman & Ananthakrishnan, 1981).

Galls may arise on any part or organ of a plant and differ widely in size, shape and structure specific to the gall forming species. Gall forming insects are generally host specific. Some are restricted to a few closely related plant species within one genus.

Approximately 15,000 gall inducing insects have been recorded from the world, of which majority belong to thrips (Thysanoptera), psyllids, aphids, coccids (Homoptera), curculionids (Coleoptera), cynipids, chalcids

(Hymenoptera), moths (Lepidoptera) and cecidomyiids (Diptera) (Rohfritsch & Short-house, 1982).

Among Diptera, cecidomyiids are the largest group of gall makers; commonly known as gall midges. The name derived from the ability of the larvae to produce galls or abnormal growths on various organs of plants (Skuhrava *et al*, 1984). They are widely distributed on most herbaceous and woody plants. Over 93% of the galls are found on Dicotyledons caused by diverse groups of insects and mites (Mani, 1964).

The fauna of gall making insects of Andaman islands is quite rich, and large number of plant species are subjected to gall formations which is quite evident from the collections of midge galls from the different islands of Andaman group during 1981-83 which forms the subject of this paper and indicates the presence of a rich fauna of gall midges and midge galls in these islands. Further extensive and intensive surveys will certainly yield fairly large number of galls.

A good work has been done on plant galls and gall makers from Indian mainland by Dr. M. S. Mani, a noted Entomologist, whose monumental and updated volume "Plant Galls of India" (1973) is the most valuable contribution to the knowledge of Indian plant galls. Incidentally a perusal of literature revealed no record of midge galls from this archipelago, thus, this study is intended to place on record the hitherto unrecorded midge galls from this part of Indian territory for a better understanding of their

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occurrence and position on the host plants and to have data on the natural population of gall midge species of economic importance and also those which are not economically important but yet associated with wild trees, shrubs and grasses in these islands to aid further studies in the field of Zoocecidology.

DESCRIPTION OF THE AREA

The Andaman islands are summits of a submarine mountain range, geologically southward continuation of the Arakan-Yoma tectonic unit. These islands are a group of picturesque islands big and small forming a narrow broken chain in the form of a North-South arc in the South East of Bay of Bengal. These are situated between latitudes $11^{\circ}20'$ and $13^{\circ}34'$ North and longitudes $92^{\circ}40'$ and $93^{\circ}9'$ E. The Andaman Islands are said to be a group of 204 islands, of which the main islands are South, Rutland, Middle and North in the main chain. Baratang group and Ritchie's Archipelago group on the east where as Labyrinth group lie on the west coast. These are separated by a very narrow but sheltered and navigable straits. Except for little Andaman which is separated from the main islands by a stretch of open sea about 60 nautical miles wide. The total land area of Andaman group is about 6340 sq km. The length of the Andaman is about 352 km and width at maximum 52 km.

The Andaman Islands are a mass of hills enclosing narrow valleys or mass of sweeping undulations. The main ranges of which run North and South. In North Andaman the Saddle range rises to a height of 750 m in Saddle Peak, the highest in Andaman group. Hills in middle Andaman rise to 560 m in Mount Diavolo, where as in South Andaman Mount Harriet range rises to 503 m in Mount Koyab.

The whole area from the waters edge to the summit of the highest hills is covered with a luxuriant growth of dense forests typical of a tropical region, heavy rainfall

and high atmospheric humidity. The vegetation is mostly Burmese and Malay type. The main forest types found in these islands are Tropical evergreen, Moist deciduous and Mangrove forests fringing the shores (Chengappa, 1950). The soil varies from sand to clay. Due to its isolation most of the islands are inhabitable and therefore carry one of the most beautiful forests in the world.

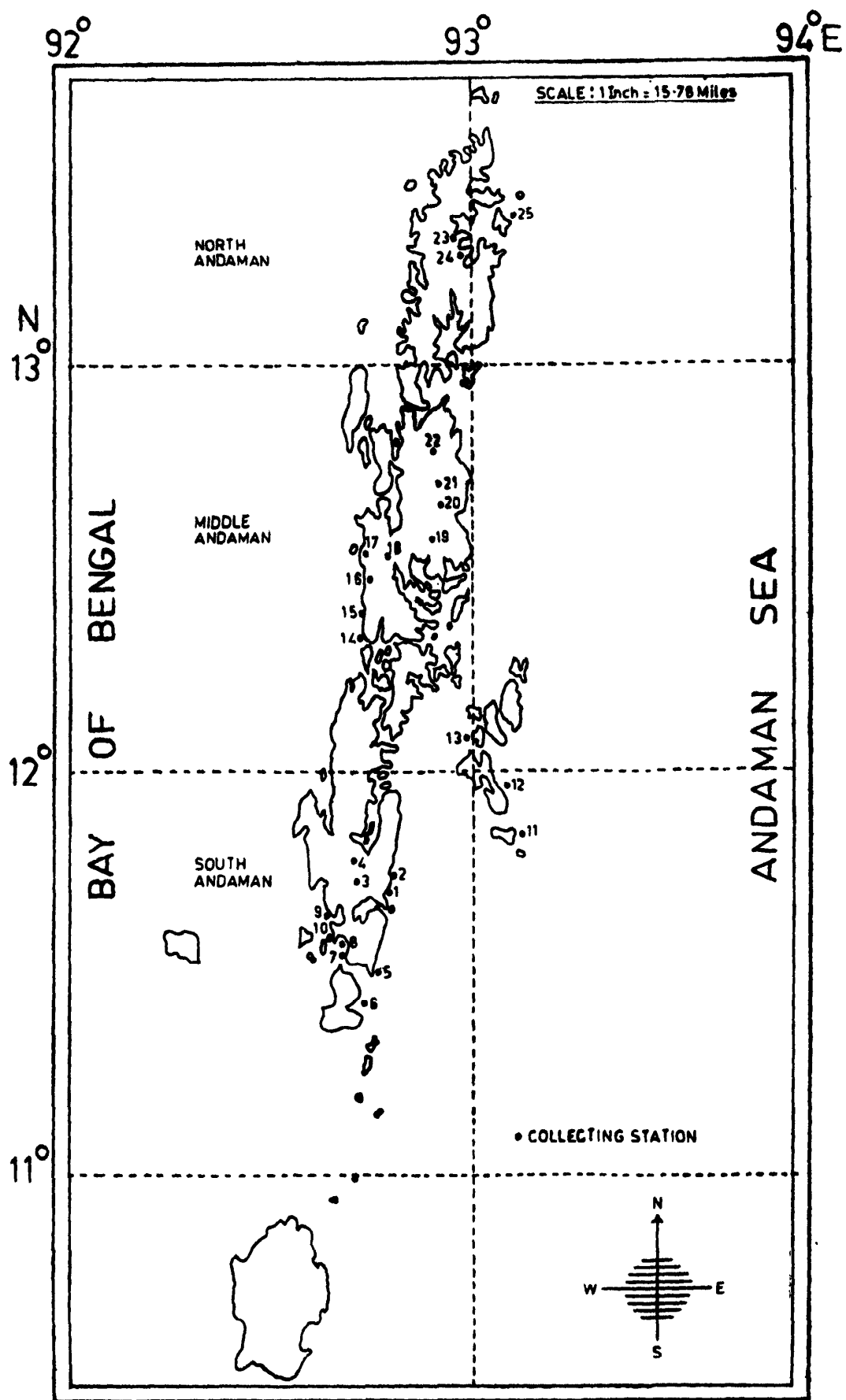
MATERIAL AND METHODS

The study of gall forming insects of Andaman islands was undertaken during 1981-83 by the author, as a result of which a large number of galls caused by diverse groups of insects and mites were collected from different localities of South, Middle and North Andaman group of islands.

Present paper deals in detail with exomorphic description and pictorial representation of galls caused by gall midges collected from the following 25 stations (Text fig. 1). The stations are serially numbered starting from South to North Andamans.

SOUTH ANDAMAN : (1) Port Blair, (2) Bambooflat, (3) Sippighat, (4) Caddlegunj, (5) Chidiatapu, (6) Rutland Island, (7) Phonigbalu, (8) Lohabari, (9) Wandoor, (10) Alexandra Island, (11) Neil Island, (12) Havelock Island, (13) Peel Island. **MIDDLE ANDAMAN :** (14) Kadamtala, (15) Shantanu, (16) Bakultala, (17) Shaktigrah, (18) Laxmanpur, (19) Parnashala, (20) Panchwati, (21) Betapur, (22) Nimbudera. **NORTH ANDAMAN :** (23) Durgapur, (24) Kalipur, (25) Smith Island.

Altogether 35 sorts of midge galls on 24 plant species have been collected. All these midge galls are new records for Andamans, while 27 are new to Indian Plant galls. The herbarium of gall bearing plants and the gall makers are deposited in the collections of Zoological Survey of India, Port Blair. Galls are identified by their numbers. The host plants were identified by Botanical Survey of India, Port Blair. Some of the plants



Text Fig. 1. Map of Andaman Islands, showing collecting Stations, 1-25.

could not be identified beyond family level and a few not even upto family level for want of flowers, fruits etc. Thus listed under unidentified plants.

Gall bearing plant parts were collected from the fields in polythene bags and carried to the laboratory. These samples were kept for rearing in glass jars. Mouth of these jars were covered with fine mesh cloth held in position by rubber bands. Some of the collected galls were dissected under binocular microscope to confirm if they were caused by midges and rest were kept for rearing the adult midges. Larvae recovered from the galls, emerged adults and parasites were collected in 70% alcohol for further studies.

Unfortunately, in many cases adults could not be recovered from galls due to their early drying and heavy parasitization and in others the material is so inadequate to identify upto species level.

DESCRIPTION OF MIDGE GALLS

The gall bearing plants are listed under their respective natural orders with gall no., name of the host plant, name/group of gall midge species, new record/new host plant record or new gall.

ANACARDIACEAE

1. Gall No. 28 : *Mangifera indica* Linn.
Procontarinia matteina Kieffer & Cecconi.
New record.

Leaf gall (Fig. 1) spherical/subspherical, discoid, depressed, solitary, glabrous, indehiscent, persistent lenticular gall, visible on both sides of the leaf blade. Yellowish when young, light-brown as grow old. Gall cavity unilocular, enclosing a single larva inside. Exit hole hypophyllous. Size of the gall varies from 1-2 mm in diameter. As many as 100 galls arise on a single leaf. This gall is practically similar to gall no. 192 of *Mani* (1973). *R. M. Sharma*, 5.5.1981, 16.6.1982, 26.11.1982.

Distribution : SOUTH ANDAMAN : Chidiatapu, Wandoor, Neil Island, and possibly

throughout Andaman Islands wherever the host is cultivated.

2. Gall No. 29 : *M. indica* Linn. *Procystiphora indica* Grover and Prasad. *New record.*

Flower buds/inflorescence are infested by this species and prevents fruit formation but show no marked deformity in the floral buds. *Mangifera indica* being an introduced species to these islands the midges must have been carried alongwith the host from mainland. Now this species has established itself as a minor pest of mango here. *R. M. Sharma*, 5.5.1981.

Distribution : SOUTH ANDAMAN : Chidiatapu, Port Blair, Wandoor, and possibly throughout South Andaman.

3. Gall No. 69 : *M. indica* Linn. Adult unknown. *New record.*

Leaf gall epiphyllous, solid, globose, glabrous, sessile, yellowish green when young, shiny, unilocular, indehiscent, persistent galls. Size about 1 mm in diameter. A large number of galls may arise on a single leaf. This gall is practically similar to gall no. 324 of *Mani* (1973) caused by *Amradiplosis echinogalliperda* *Mani* and possibly the same species causes this gall in Andamans also. *R. M. Sharma*, 9.12.1983.

Distribution : NORTH ANDAMAN : Smith Island.

4. Gall No. 30 : *Mangifera sylvatica* Roxb. (?). Adult unknown. *New gall.*

Leaf gall (Fig. 2, 3) Epi-hypophyllous, sessile, solitary, perfoliate, solid, non-localized, smooth, yellowish, truncated conical, operculate at lower surface of the leaf; rostrate (beak-shaped), greenish, and costate at upper surface, indehiscent, persistent, pouch-gall. Gall cavity unilocular enclosing a single whitish or orange coloured larva inside. Larva with bilobed sternal spatula. Size of the gall varies from 1-4 mm high above leaf surface and 1-3 mm in diameter

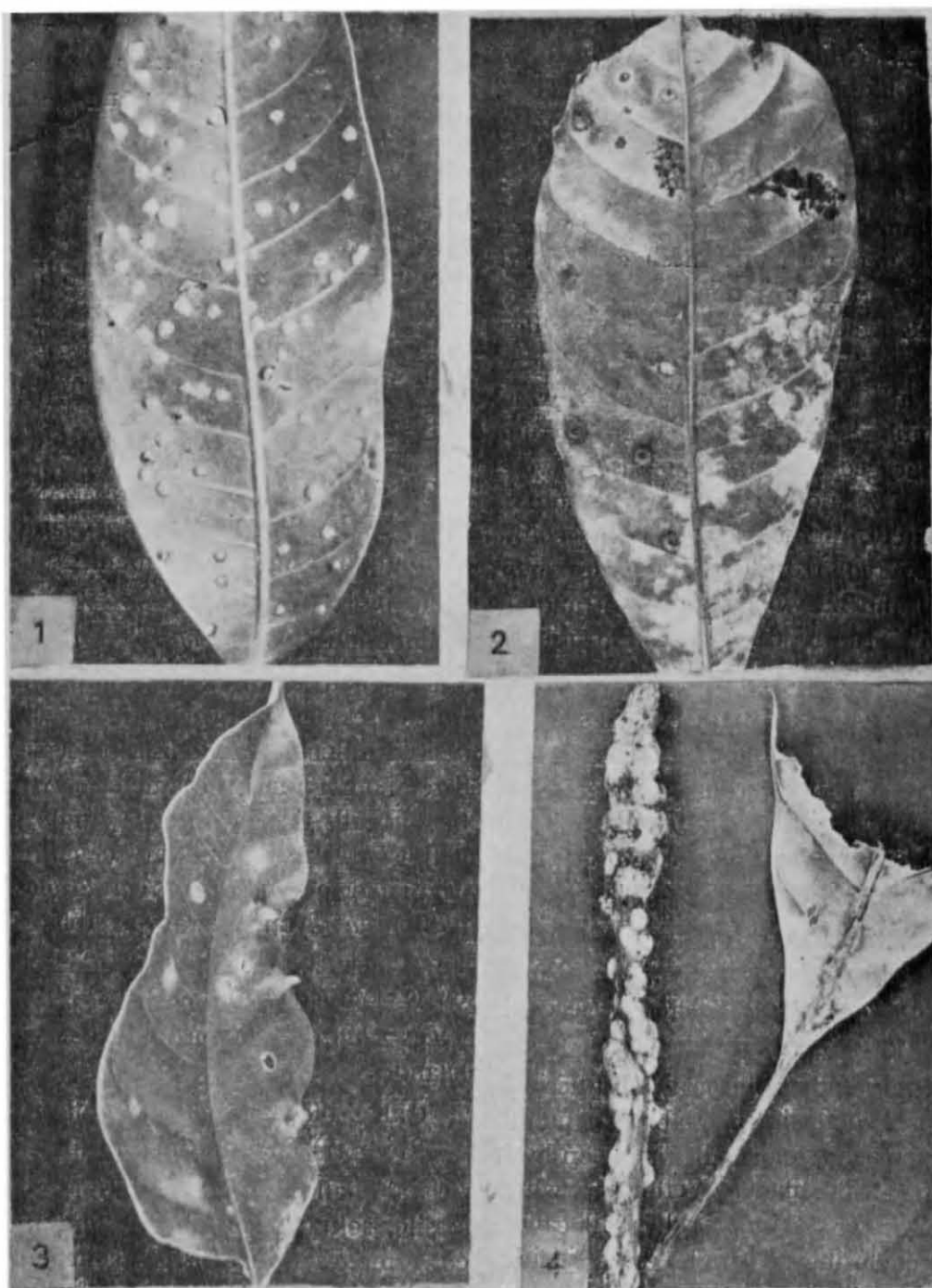


Plate I : Figs. 1-4 : 1. Gall No. 28 on leaf of *Mangifera indica* Linn. 2. Gall No. 30 on leaf of *M. sylvatica* Roxb. (Lower surface). 3. Same (upper surface). 4. Gall No. 31 on stem of *M. sylvatica* Roxb.

and 1-3 mm high at lower surface of the leaf. Number of galls per leaf ranges from 5-35. R. M. Sharma, 21.2.1983.

Distribution : MIDDLE ANDAMAN : Bakul-tala.

5. Gall No. 31 : *Mangifera sylvatica*

Roxb. (?). Adult unknown. *New host record.*

Shoot axis/leaf gall (Fig. 4). Rindengall, subglobose, mostly developing in a linear series, spirally into irregular, agglomerate,

rarely isolated, indehiscent, persistent swellings on tender branches ; in case of leaf gall, elongated, oval swellings in a series confined to midrib on both the sides of the leaf blade. This gall is practically similar to gall no. 197

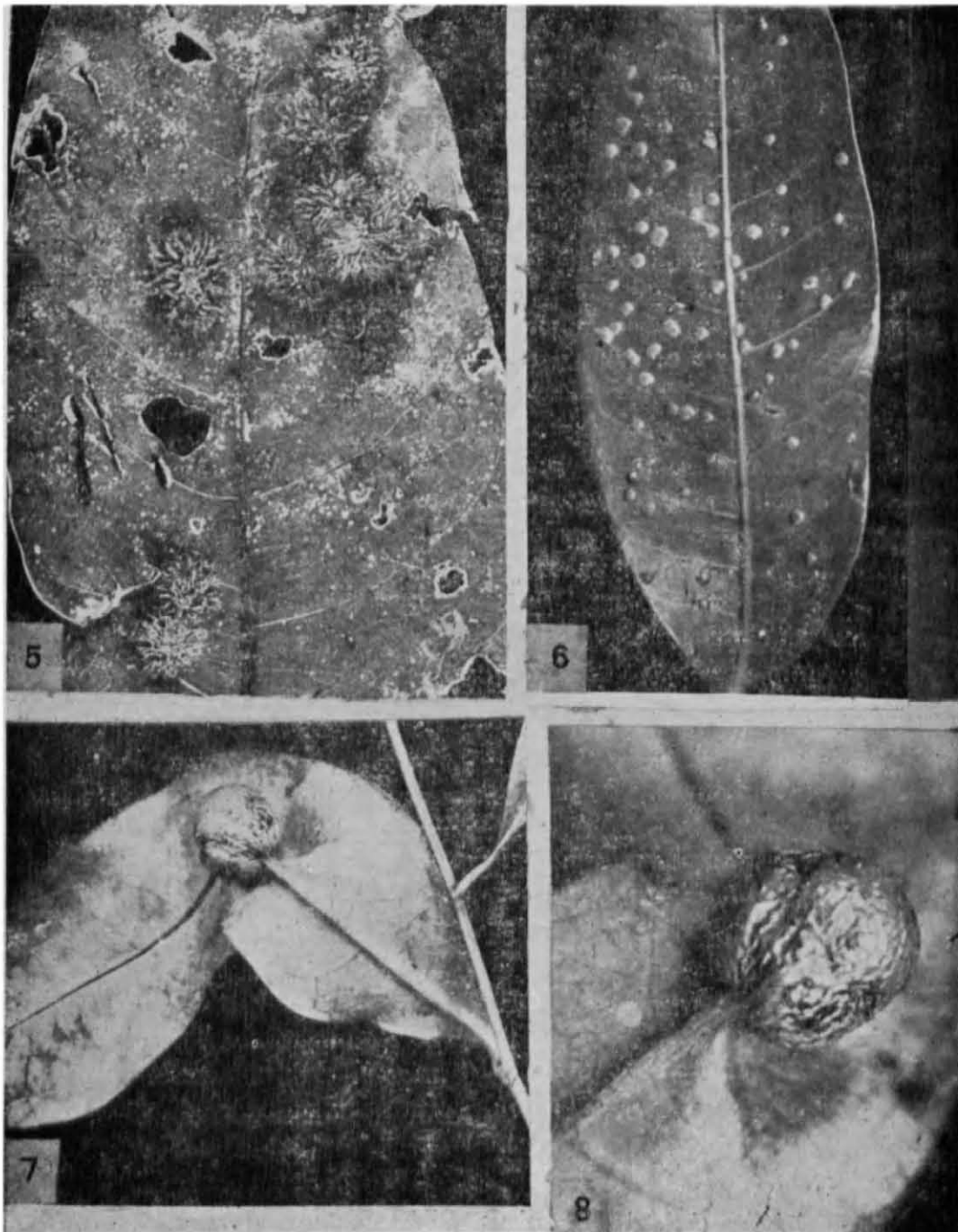


Plate II : Figs. 5-8 : 5. Gall No. 32 on leaf of *Mangifera sylvatica* Roxb. (Enlarged). 6. Gall No. 33 on leaf of *M. sylvatica* Roxb. 7. Gall No. 17 on leaf of *Phaeanthus andamanicus* King. 8. Same enlarged.

of Mani (1973) produced on *M. indica* and may be caused by the same species on this host species. Size of a single gall 3-4 mm and agglomerate mass measures upto 40-60 mm in length. This gall and gall no. 30 described above coexist on the same plant. *R. M. Sharma*, 21.2.1983.

Distribution : MIDDLE ANDAMAN : Bakultala.

6. Gall No. 32 : *Mangifera sylvatica* Roxb. (?). Adult unknown. *New host record*.

Leaf gall (Fig. 5). Epiphyllous, globose/subglobose, sessile, solitary or paired at times 6-7 galls agglomerate, solid, indehiscent, persistent uni or bilocular pouch-galls, covered with dense elongate, stout spiny whorls giving the appearance of a miniature sea-urchin to the gall, greenish when young but turns reddish-brown as grow old. This gall is very much similar to the gall no. 196 of Mani (1973) produced on *M. indica* and possibly caused by the same species. Size of the gall varies from 4-7 mm in diameter and 5-40 galls may arise on a single leaf. *R. M. Sharma*, 22.2.1983, 26.2.1983.

Distribution : MIDDLE ANDAMAN : Bakultala, Panchawati.

7. Gall No. 33 : *Mangifera sylvatica* Roxb. (?). Adult unknown. *New host record*.

Leaf gall (Fig. 6). Epiphyllous, spherical/subspherical, discoid, depressed, smooth, sessile lenticular gall. This gall is identical in all respects with gall no. 28 of present study and gall no. 192 of Mani (1973) produced on *M. indica* and probably caused by the same species. *R. M. Sharma*, 26.2.1983.

Distribution : MIDDLE ANDAMAN : Panchawati.

ANONACEAE

8. Gall No. 17 : *Phaeanthus andamanicus* King. *Asphondylia* sp. *New gall*.

Leaf gall (Fig. 7, 8). Mostly hypophyllous very rarely epiphyllous, usually confined to

midrib, may occur at times on one of the larger lateral veins ; globose/subglobose or irregular, solid, sessile, hard, glabrous ; gall surface rugose, indehiscent, persistent pouch-gall ; greenish when young, blackish as grow old. Gall cavity multilocular containing many larvae inside. Pupation inside the gall itself. Usually single gall per leaf, rarely 1-3 agglomerated, at times complete leaf gets transformed into the gall leaving no trace of leaf blade. Size of the gall varies from 10-25 mm in diameter and 5-20 mm in length. A number of exit holes seen on a mature gall. Two species of chalcids (Hymenoptera) parasitize this gall midge species. *R. M. Sharma*, 17.4.1982 ; Feb./March, 1983. Earlier, Sharma (1984) described this gall as caused by unknown insect since adult midges could not be reared from this gall that time, but subsequent rearings proved it to be caused by a gall midge species.

Distribution : SOUTH ANDAMAN : Chidiatapu. MIDDLE ANDAMAN : Common throughout the island and possibly in all the Andaman Islands.

APOCYNACEAE

9. Gall No. 34 : *Parameria laevigata* (Juss.) Moldenke. Adult unknown. *New gall*.

Stem gall (Fig. 9). Globose/subglobose or elongated oval, solitary, solid, hard, woody, verrucose, rough, brown, indehiscent, persistent cortical gall ; occur mostly at the base of two leaves, whose petioles get partly inserted in the gall. Gall cavity unilocular, elongated, axial, situated in the centre containing a single whitish larva inside. Larva bears bilobed sternal spatula with a long shaft. Pupation in the gall itself. Size of the gall varies from 7-15 mm long and 7-12 mm in diameter. A single tender branch may bear 1-3 galls. *R. M. Sharma*, 2.3.1983.

Distribution : MIDDLE ANDAMAN : Beta-pur.

10. Gall No. 35 *Parsonsia alboflavescens* (Dennst.) Mabberly. Adult unknown. *New gall*.

Leaf gall (Fig. 10, 11). Epi-hypophyllous equally visible on both sides of the leaf blade globose/subglobose, solid, sessile, solitary or (perfoliate), glabrous, non-localized, indehiscent, persistent pouch-gall. Light-greenish or paired swellings but never agglomerate.

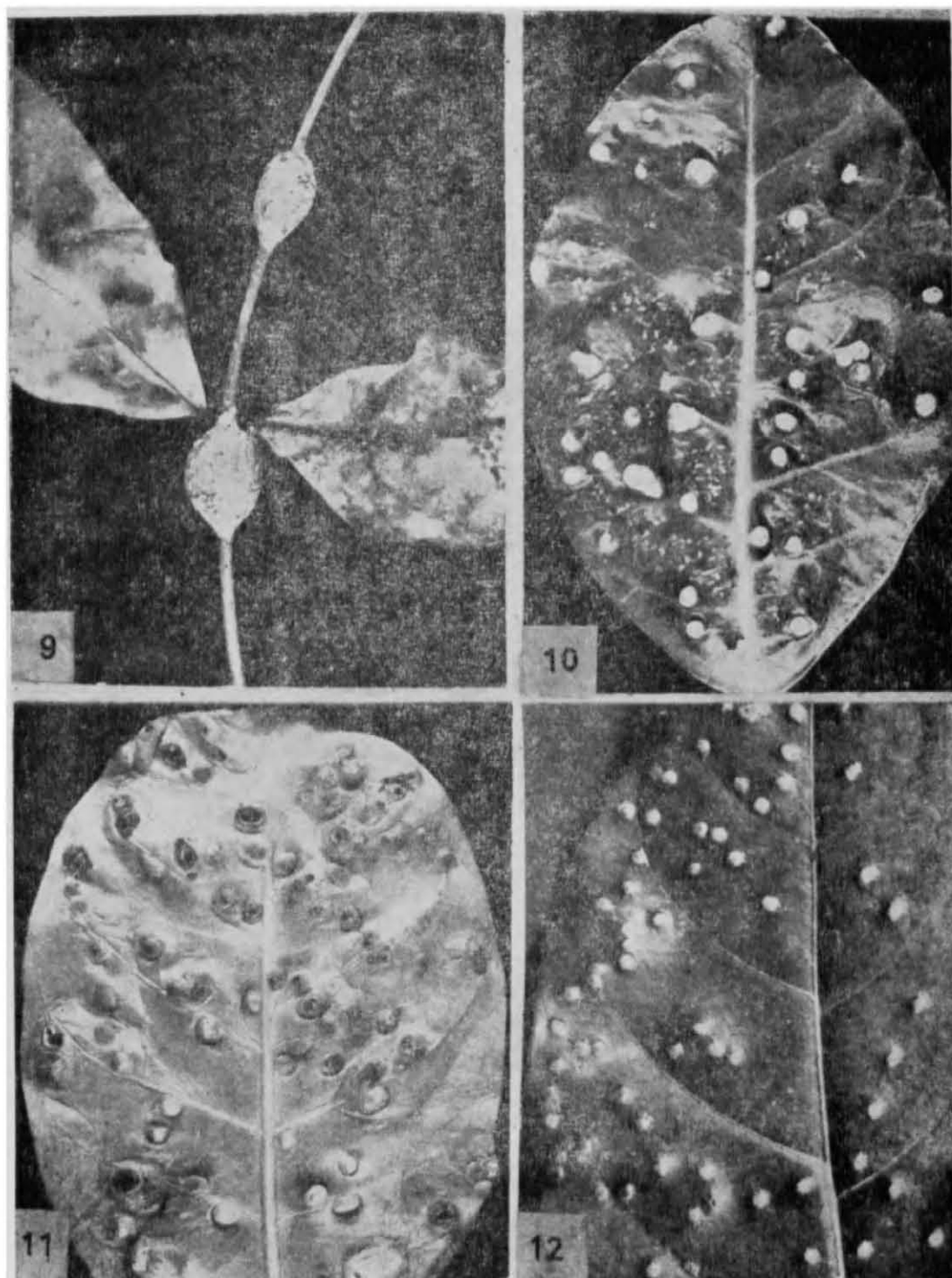


Plate III : Figs. 9-12 : 9. Gall No. 34 on stem of *Parameria laevigata* (Juss.) Moldenke. 10. Gall No. 35 on leaf of *Parsonsia alboflavescens* (Dennst.). Mabblerly (Upper surface) 11. Same (Lower surface). 12. Gall No. 61 on leaf of undertermined plant of Apocynaceae.

light-reddish when young, dark brown as grow old. Gall cavity unilocular filled up with milky fluid, enclosing 1-3 larvae inside; larvae orange coloured with bilobed sternal spatula; fourth instar larvae drop out of the gall and have jumping habit which suggests that pupation takes place outside the gall and within the larval skin together with some fine white threads. No change in the colour of the pupae was observed. As many as 50 galls may arise on a single leaf. Size of the gall varies from 1-3 mm in diameter at both the sides of the leaf blade. R. M. Sharma, 19.1.1983. A Predatory gall midge, *Trisopsis* sp. was reared out of this gall.

Distribution : SOUTH ANDAMAN : Have-lock Island (Govindnagar).

11. Gall No. 61 : Undetermined plant, Adult unknown. *New gall*.

Leaf gall (Fig. 12). Epi-hypophyllous, spherical/subspherical, non-localized lenticular swellings, perfoliate, solitary or paired but never agglomerate, sessile, glabrous, fleshy, shiny, greenish-yellow, indehiscent, persistent pouch-gall, becomes brown as grow old. Gall cavity mostly one but rarely two chambered containing 1-2 orange or yellow coloured larvae inside. Mature larvae drop out of galls to pupate outside. Larvae with bilobed sternal spatula. Exit hole epi or hypophyllous. Two species of chalcids were found parasitizing midge larvae. Size of the gall varies from 1-4 mm in diameter. As many as 100 galls may arise on a single leaf. Almost every leaf is studded with a large number of galls. R. M. Sharma, 16.6.1982, 21.2.1983, 24.9.1983.

Distribution : SOUTH ANDAMAN : Wandoor. MIDDLE ANDAMAN : Bakultala, Laxmanpur.

AVICENNIACEAE

12. Gall No. 3 : *Avicennia marina* (Forsk.) Vier. *Brachyneura* sp. *New gall*.

Leaf gall (Fig. 13). Hypophyllous, glo-

bose, or sub-globose, sessile, solitary, solid, fleshy, glabrous pouch-gall, greenish yellow when young turning brown to dark brown with age; indehiscent, persistent; gall cavity multilocular containing whitish larvae inside; larva with bilobed sternal spatula; pupation inside the gall itself, ostiole epiphyllous; size of the gall varies from 5-8 mm in diameter and 2-3 mm high on lower surface of the leaf and 2-3 mm in diameter on upper surface; number of galls per leaf ranges from 1-3. R. M. Sharma, 16.6.1982; 23.2.1983, 4.2.1984. Earlier, Sharma, *et al.* (1983) observed this gall as caused by unknown Diptera but on its subsequent collection and rearing proved its causative agent as gall midge species. Larvae parasitized by chalcids.

Distribution : SOUTH ANDAMAN : Wandoor, Bambooflat, Lohabari. MIDDLE ANDAMAN : Bakultala.

13. Gall No. 4 : *Avicennia marina* (Forsk.) Vier. Lasiopteridi midge not identified, *New gall*.

Leaf gall (Fig. 14). Discoid, lenticular, compressed, solitary or paired but never agglomerate, glabrous, rugose, pouch-gall nearly equally visible from both sides of the leaf blade, dark yellow when young but copper red as grow old, indehiscent, persistent; gall cavity unilocular containing many larvae inside, pupation inside the gall cavity, pupal period 3-4 days; larvae parasitized by chalcids (Hymenoptera); ostiole hypophyllous, minute, usually 5-14 exit holes seen in a mature gall. Size 5-12 mm in diameter, number of galls per leaf varies from 1-4. M. K. Dev Roy & B. Mitra, 26.6.1982, 21.5.1983.

Distribution : SOUTH ANDAMAN : Lohabari.

14. Gall No. 6 : *Avicennia marina* (Forsk.) Vier. Lasiopteridi, midge not identified. *New gall*.

Leaf gall (Fig. 15). This gall has been ade-

quately described by Sharma, *et al.*, (1983) but it was erroneously reported as a Homopteran gall. Further collections and rear- ings have confirmed the causative agent, a gall midge species. R. M. Sharma, 2.6.1982, 9.12.1983.

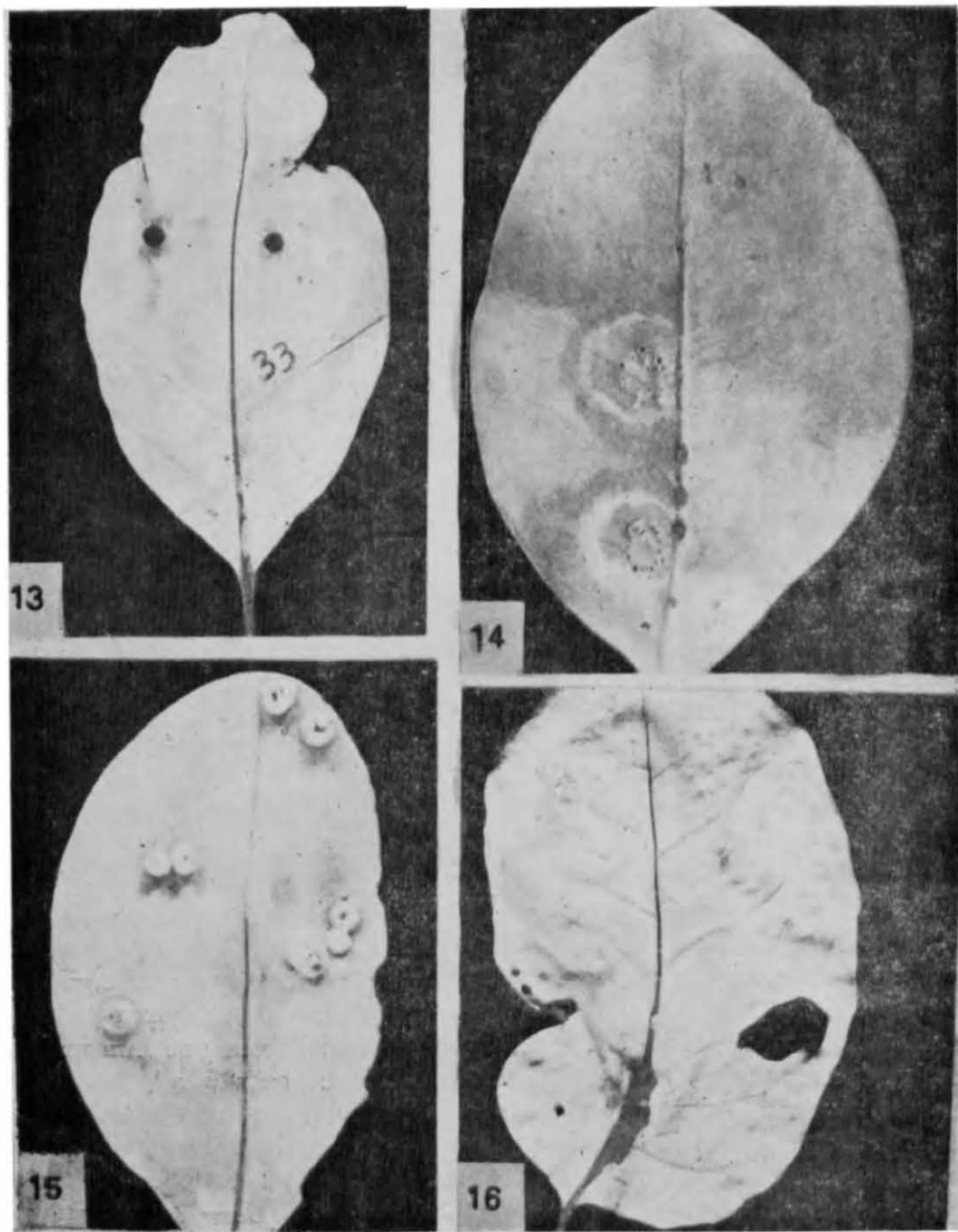


Plate IV : Figs. 13-16 : 13. Gall No. 3 on leaf of *Avicennia marina* (Forsk.) Vier. 14. Gall No. 4 on leaf of *Avicennia marina* (Forsk.) Vier. 15. Gall No. 6 on leaf of *Avicennia marina* (Forsk.) Vier. 16. Gall No. 8 on leaf of *Avicennia marina* (Forsk.) Vier.

Distribution : SOUTH ANDAMAN : Phongi-balu, Bambooflat. NORTH ANDAMAN : Smith Island.

15. Gall No. 8 : *Avicennia marina* (Forsk.)

Vier. *Brachyneura* sp. New gall.

Leaf gall (Fig. 16). Epi-hypophyllous, elongated, oval or irregular, mostly confined to midrib only, equally developed on both sides of the leaf blade, solid, glabrous, indehiscent, persistent pouch-gall; greenish when young, becomes brown as grow old. Gall cavity uni or multilocular containing a single or more larvae inside, larvae whitish with bilobed sternal spatula, parasitized by chalcids. Exit holes may appear on lower or upper surface of the leaf at lateral side of the gall. This gall co-exist with gall no. 3, possibly caused by the same species but treated here as a different gall due to its shape, size and location of the gall on leaf. Size varies from 5-40 mm in length and 3-5 mm high above the leaf surface. Mostly a single gall per leaf, at times 2-3 galls may arise on a single leaf. R. M. Sharma, 23.2.1983, 4.2.1984.

Distribution : SOUTH ANDAMAN : Lohabari, MIDDLE ANDAMAN : Bakultala.

GNETACEAE

16. Gall No. 15 : *Gnetum acutum* Markgr.

Asphondylia sp. New gall.

Leaf gall (Fig. 17). Mostly epiphyllous, erect, free, solitary or at times two galls unite at the base but never agglomerate, fusiform, pedicellate or sessile, operculate, stout, thick-walled, fleshy, solid, glabrous, indehiscent, persistent pouch-gall, inserted on the midrib or one of the larger lateral veins, greenish or light brown when young, dark brown to black on ageing. Gall cavity unilocular, axial, elongate, wide, cylindrical and extending from nearly the very base of the gall to its tip. A single larva per gall; pupation inside the gall itself. Exit hole at its tip. Size of the gall varies from 10-25 mm high above leaf surface and 4-7 mm thick at the

centre. Number of galls per leaf varies from 2-5. M. K. Vasudeva Rao, 23.1.1982; R. M. Sharma, 16.2.1983, 7.3.1983, 11.12.1983. Earlier, Sharma (1984) reported this gall as caused by unknown diptera since no adult was recovered from the galls, but subsequent rearings revealed that the gall-maker is a gall-midge species. Two different species of chalcids parasitize midge larvae.

Distribution : SOUTH ANDAMAN : Rutland Island. MIDDLE ANDAMAN : Shantanu, Nimbudera. NORTH ANDAMAN : Durgapur.

17. Gall No. 36 : *Gnetum acutum* Markgr.

Asphondyliidi. Midge not identified. New gall.

Leaf gall (Fig. 18, 19). Mostly hypophyllous very rarely epiphyllous; foveate on upper surface of the leaf, globose, subglobose, sessile, solitary or paired on lower surface, at times 5-6 galls appear in a series closely attached to each other but never agglomerate; broadly inserted on the leaf blade, usually confined to midrib or one of the larger lateral veins, solid, hard, glabrous, indehiscent, persistent, pouch-gall; light-yellow to dark-green when young becoming light to dark-brown as grow old. Gall cavity multi-chambered, elongated, axial, situated in the centre; each chamber contains 1-6 orange coloured larvae inside; larva with dark brown bilobed sternal spatula and a comparatively longer shaft, lobes of spatula pointed. On an average 10 larvae per gall were observed. Pupation takes place outside the gall as pupae drop-out of the gall. Larvae parasitized by chalcids (Hymenoptera). Size of the gall varies from 5-20 mm in diameter and number of galls per leaf ranges from 1-19. Usually 10-15 exit holes seen on a mature gall. R. M. Sharma, 16.6.1982, 16.2.1983, 7.3.1983, 21.5.1983.

Distribution : SOUTH ANDAMAN : Wandoor, Lohabari, MIDDLE ANDAMAN : Shantanu, Nimbudera.

Remarks : Swamy & Krishnamurthy (1975) reported 4 types of different galls caused by

unknown insects on *Gentum ula* from Kasaragod district (Kerala State), but the galls reported in the present paper on *G. acutum* are morphologically distinct from the galls of *G. ula*.

GRAMINAE

All these species listed below infest inflorescence of grasses, affecting seed production and show no marked gall formation or deformity

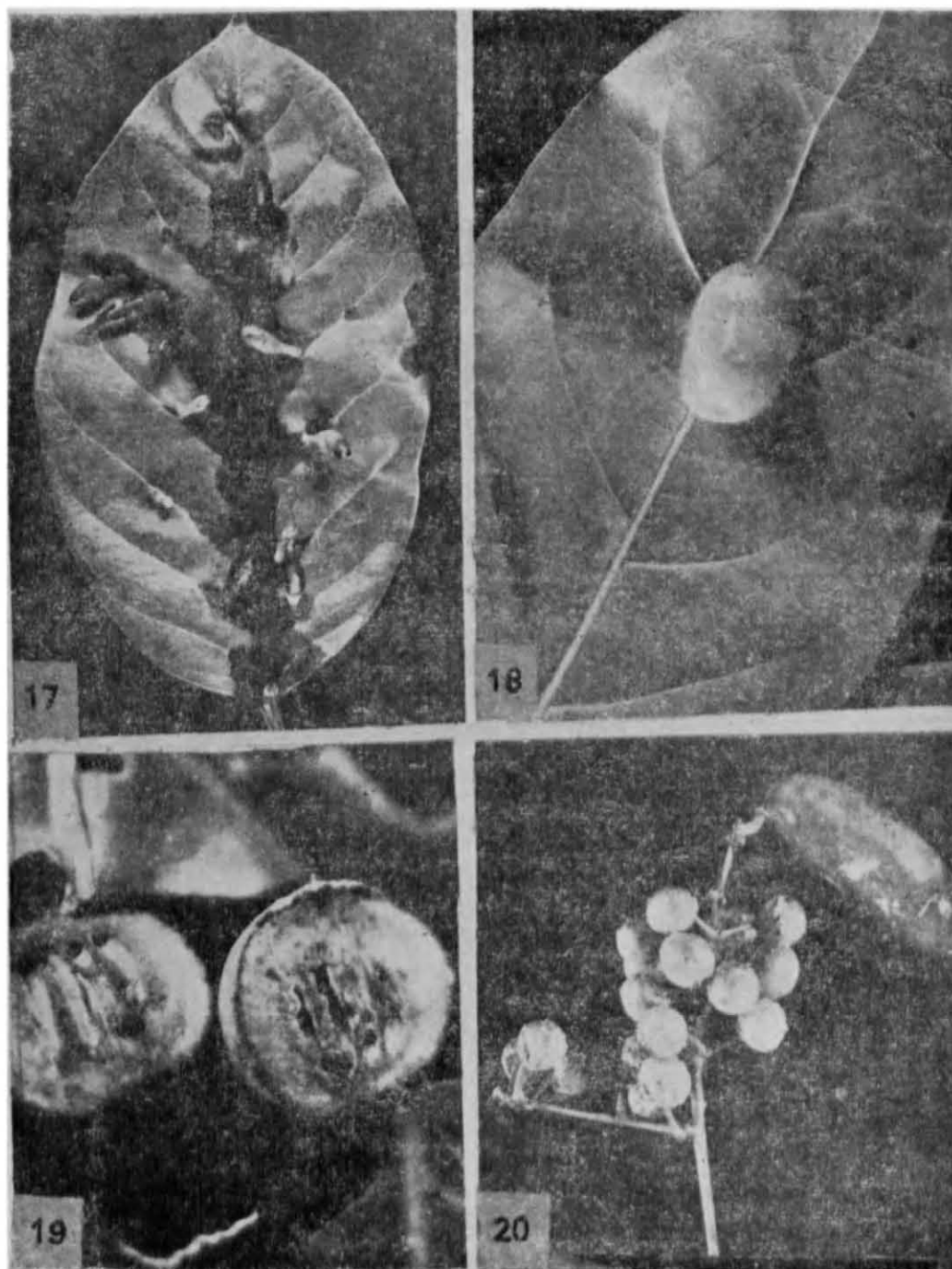


Plate V : Figs. 17-20 17. Gall No. 15 on leaf of *Gentum acutum* Markgr. 18. Gall No. 36 on leaf of *Gentum acutum* Markgr. 19. Cross section of the same to show multichambered gall cavity. 20. Gall No. 65 on flowers of *Pongamia pinnata* (L.) Pierre Vent.

18. Gall No. 37 : *Axonopus compressus* (SW.) P. Beauv. *Lasioptera* sp. *New gall*.
R. M. Sharma, 6.8.1981.

Distribution : SOUTH ANDAMAN : Sippi-ghat, CPCRI Farm.

19. Gall No. 38 : *Brachiaria rapatens* (Linn.) Gardn. & Hubb. *Lasioptera* sp. *New gall*.
R. M. Sharma, 4.8.1981.

Distribution : SOUTH ANDAMAN : Sippi-ghat, CPCRI Farm.

20. Gall No. 39 : *Cyrtococcum accrescens* (Trin.) Stapf. *Lasioptera* sp. *New gall*.
R. M. Sharma, 26.10.1981, 27.2.1983.

Distribution : SOUTH ANDAMAN : Carbyn's Cove. MIDDLE ANDAMAN : Rangat.

21. Gall No. 40 : *Digitaria sanguinalis* (Linn.) Scop. *Lasioptera* sp. *New gall*.
R. M. Sharma, 27.7.1981.

Distribution : SOUTH ANDAMAN : Sippi-ghat, CPCRI Farm.

22. Gall No. 41 : *Eragrostis unioides* (Retz.) Stapf. *Contarinia eragrostidis* Felt. *New record*.

R. M. Sharma, 27.11.1981, 13.12.1982, 23.9.1983.

Distribution : SOUTH ANDAMAN : Dhani-khari, Port Blair (South point), Manarghat, Wandoor.

LEGUMINOSAE

23. Gall No. 65 : *Pongamia pinnata* (Linn.) Pierre Vent. Adult unknown ; probably *Asphondylia pongamiae* Felt. *New record*.

Floral gall (Fig. 20). Spherical, solid, hard, rough, corky, light brown, solitary or at times two galls joined together, indehiscent, persistent, thick-walled, nut-like swellings on the pedicels of flowers resembling a fruit, arise in a large number and make it difficult to find the normal legume ; gall cavity uni or bi-chambered. Size varies from 8-10 mm in diameter. R. M. Sharma, 10.12.1983.

Basically this gall is known to be caused by *Asphondylia pongamiae* Felt, and has been reported from Coimbatore, Tanjore,

Bangalore, Calcutta and Dacca ; Grover (1972) collected the similar galls from Allahabad but failed to obtain *Asphondylia* sp. instead she reared many specimens of *Stictodiplosis*. Similarly I also failed in rear-
ing *Asphondylia* sp. from this gall which is practically similar to gall no. 202 of Mani (1973), instead I could recover a single ♂ midge apparently neither *Asphondylia* nor *Stictodiplosis* (Now called *Contarinia*) along-
with Hymenopterous parasites. However, I am inclined to state that the same midge causing gall elsewhere might occur in these islands too.

Distribution : NORTH ANDAMAN : Smith Island.

MORACEAE

24. Gall No. 42 : *Ficus racemosa* Roxb. *Cystiphora* sp. *New gall*.

Leaf gall (Fig. 21). Circular, depressed, biconvex, solitary, sessile, solid, glabrous, indehiscent, persistent lenticular gall ; visible on both sides of the leaf blade, some what more pronounced on lower surface of the leaf ; dark green when young turns light brown when mature. Gall cavity multilo-
cular enclosing 2-3 whitish larvae inside, pupation takes place in the gall itself. Exit hole hypophyllous. Size of the gall varies from 4-6 mm in diameter and 2-5 galls arise on a single leaf. R. M. Sharma, 17.4.1982.

Distribution : SOUTH ANDAMAN : Caddle-gunj.

MELIACEAE

25. Gall No. 43 : *Amoora wallichii* King. Adult unknown. *New gall*.

Leaf gall (Fig. 22). Mostly epiphyllous, globose/subglobose, sessile, solitary or paired but never agglomerate, solid, hard, woody, glabrous, non-localized, indehiscent, persis-
tent pouch-gall ; light brown to dark brown in colour. Gall cavity multilocular enclosing 2-3 orange coloured larvae inside. Larva with bilobed sternal spatula. Pupation in-
side the gall itself. Exit hole epiphyllous.

Larvae heavily parasitized by chalcids. Size of the gall varies from 3-5 mm in diameter and 2-3 mm high above the leaf surface. Number of galls per leaflet ranges from 1-7.

R. M. Sharma, 19.2.1983, 26.2.1983, 24.9.1983.

Distribution : SOUTH ANDAMAN : Wandoor ; Phongibalu. MIDDLE ANDAMAN : Shaktigrah. Panchawati.

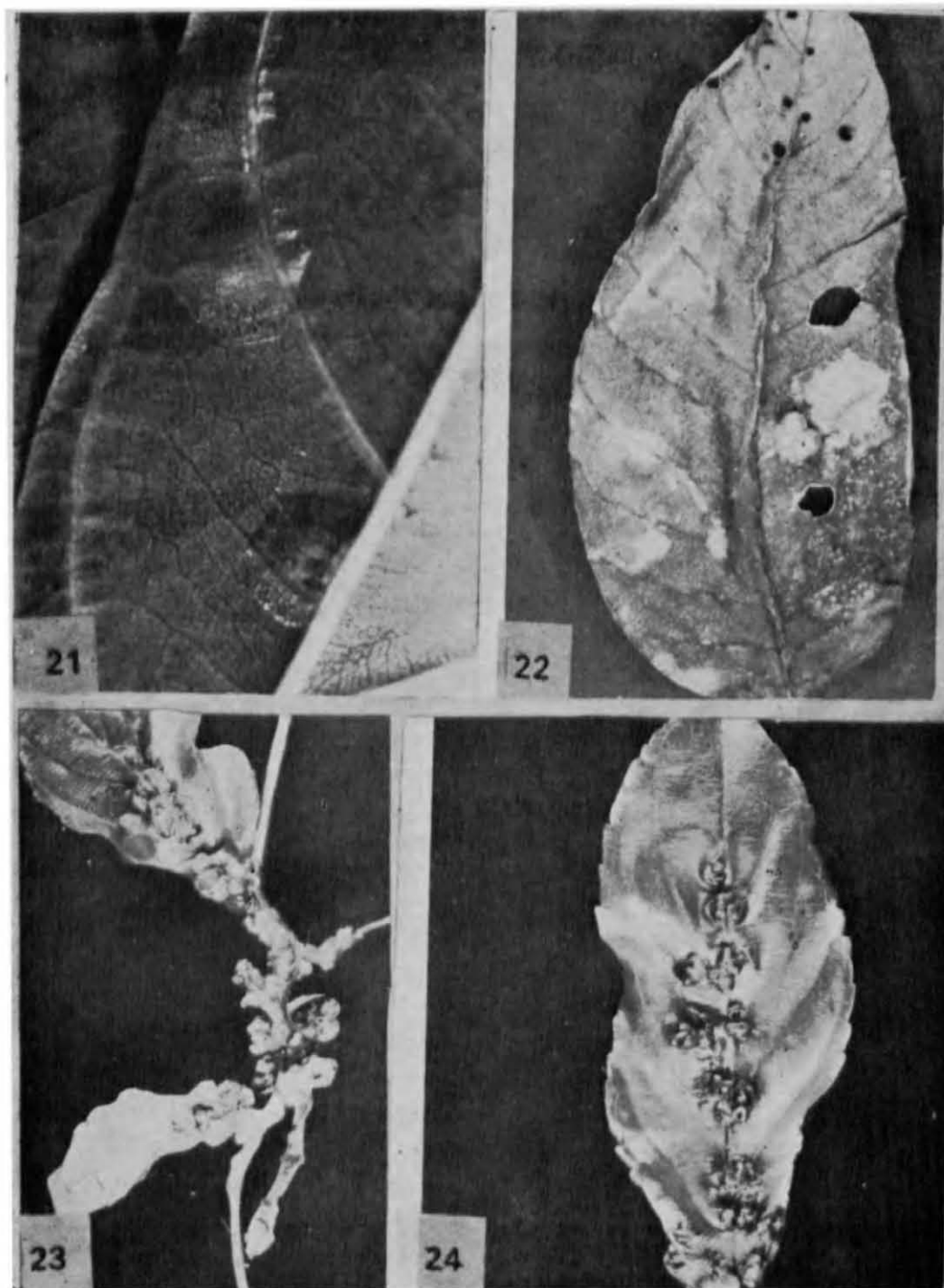


Plate VI : Figs. 21-24 : 21. Gall No. 42 of leaf of *Ficus racemosa* Roxb. 22. Gall No. 43 on leaf of *Amoora walli-chii* King. 23. Gall No. 44 on stem of *Ventilago madraspatana* Gaertn. 24. Same on leaf.

RHAMNACEAE

26. Gall No. 44 : *Ventilago madraspatana* Gaertn. Adult unknown, Cecidomyiidi, New gall.

Leaf/petiole/stem gall (Fig. 23, 24). Epi-Hypophyllous, globose/subglobose, sessile, solid, hard, glabrous, indehiscent, persistent, dark green, pouch-gall, all along the petiole, midrib or one of the larger lateral veins in case of leaf gall; may be solitary or paired but generally many galls agglomerate resulting in the crinkling of the leaf. Stem gall comprise elongated, oval agglomerated mass, gall cavity one or many chambered enclosing a single or more light yellow coloured larvae inside. Larvae with bilobed sternal spatula and parasitized by chalcids. Exit hole epi or hypophyllous. A large number of minute circular exit holes seen on a mature gall. Size of the solitary gall varies from 0.5 mm to 2 mm in diameter and agglomerated mass measures upto 40 mm in length. Practically whole plant is studded with hundreds of galls. R. M. Sharma, 2.3.1983, 7.3.1983.

Distribution : MIDDLE ANDAMAN : Betapur, Nimbudera.

RUBIACEAE

Following three morphologically distinct types of galls co-exist on the same host plant and many times the leaves of a single plant may harbour all types, indicative of a corresponding number of causative organisms.

27. Gall No. 45 : *Randia curvata* (T. & B.) Valet. *Polystepha* sp. New gall.

Leaf gall (Fig. 25, 26). Mostly hypophyllous, rarely epiphyllous, solitary or paired but never agglomerate, sessile, loosely inserted on the leaf blade, non-localized, glabrous, solid, moderately hard, barrel-shaped, pyxidial gall; indehiscent, persistent, light-green to dark-green when young. Larval cavity elongated, cylindrical, situated in the centre enclosing a single yellowish-green larva inside, larval cavity plugged with subglobular lid which falls off when adult emerge out.

Larva with bilobed sternal spatula. Larvae parasitized by a chalcid and a braconid (Hymenoptera). This gall is practically similar in appearance to the one described by Yukawa (1974) from Japan on *Machilus thunbergii* Sieb. et Zucc. : (Lauraceae) caused by *Daphnephila machilicola* Yukawa. Size of the gall varies from 3-8 mm high above leaf surface and 3-5 mm in diameter at the base. Number of galls arising on a single leaf varies from 5-100. R. M. Sharma, 19.2.1983, 24.2.1983, 26.2.1983, 1.3.1983, 9.12.1983.

Distribution : MIDDLE ANDAMAN : Shaktigarh, Parnashala, Panchawati, Betapur and very common throughout the Island. NORTH ANDAMAN : Smith Island, Durgapur, Kalipur.

28. Gall No. 46 : *Randia curvata* (T. & B.) Valet. Cecidomyiidi, midge not identified. New gall.

Leaf gall (Fig. 27). Spherical, discoid, depressed, sessile, solitary or paired but never agglomerate, solid, glabrous, indehiscent, persistent lenticular gall, equally visible from both sides of the leaf blade, somewhat more pronounced on lower surface of the leaf, greenish-yellow when young, becomes light-brown to brown on ageing. Gall cavity unilocular enclosing a single larva inside. Pupation inside the gall itself. Exit hole epiphyllous. Size of the gall varies from 4-8 mm in diameter. 2-30 galls occur on a single leaf. Chalcids parasitize midge larvae. R. M. Sharma, 16.6.1982, 18.1.1983, Feb./March, 1983, 11.12.1983.

Remarks : From deserted galls, filled-up with fungal hyphae, a few examples of *Lasioptera* sp. were reared on two occasions; which suggest the possibility of secondary invasion of fungus and the *Lasioptera* sp. through exit holes.

Distribution : SOUTH ANDAMAN : Wandoor, Chidiatapu. MIDDLE ANDAMAN : Very common throughout the Island. NORTH ANDAMAN : Smith Island, Durgapur, Kalipur.

29. Gall No. 47 : *Randia curvata* (T. & B.) Valet. *Polystepha* sp. New gall. broadly inserted on the leaf blade; non-localized, broadest at base, gradually narrowed apically; greenish when young, becoming light brown to dark brown as grow old; in-
- Leaf gall (Fig. 28). Epi or hypophyllous, sessile, solitary, glabrous, solid, loosely but

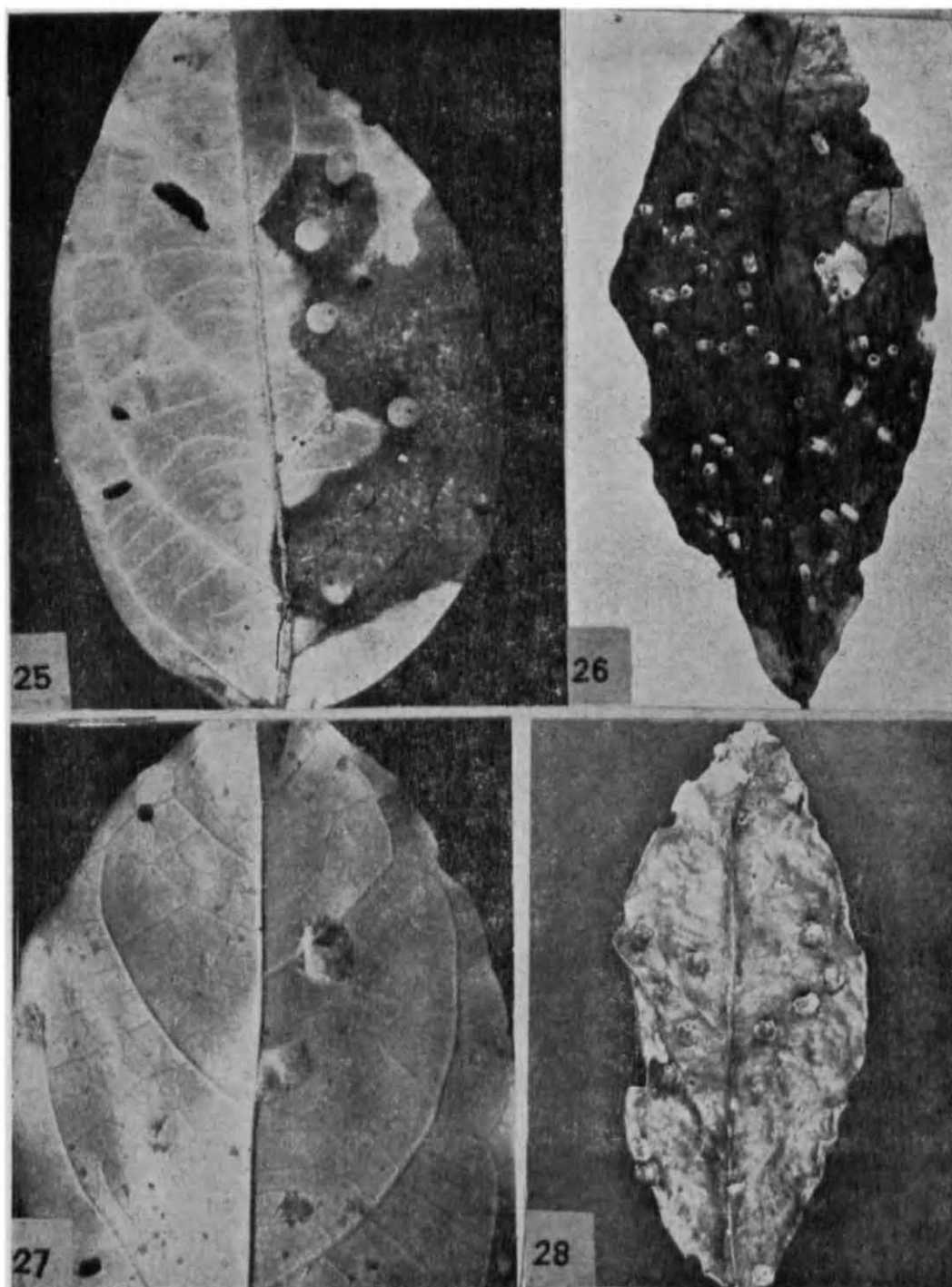


Plate VII : Figs. 25-28 : 25. Gall No. 45 on leaf of *Randia curvata* (T. & B.) Valet. 26. Same (Older galls). 27. Gall No. 46 on leaf of *Randia curvata* (T. & B.) Valet. 28. Gall No. 47 on leaf of *Randia curvata* (T. & B.) Valet.

dehiscent, persistent pouch-gall. Larval cavity unilocular situated at the centre containing a single yellowish or greenish larva inside; larva with bilobed sternal spatula, pupation inside the gall itself, adults emerge out by making an exit hole at the lateral side of the gall. Size of the gall varies from 1.5 mm in diameter at base. At least three different chalcids parasitize midge larvae. As may as 50 galls may arise on a single leaf. *R. M. Sharma*, 17.4.1982, 16.6.1982, 18.1.1983, Feb./March 1983, 9.12.1983.

Distribution : SOUTH ANDAMAN : Chidiatapu, Wandoor, Havelock Island. MIDDLE ANDAMAN : Very common throughout the Island. NORTH ANDAMAN : Smith Island.

VERBENACEAE

30. Gall No. 48 : *Sphenodesme involucrata* (Presl.) Robins. Adult unknown. *New gall*.

Leaf gall (Fig. 29). Mostly epiphyllous rarely hypophyllous sessile, solitary, glabrous, solid, loosely but broadly inserted on the leaf blade, non-localized, roughly spherical, indehiscent, persistent pouch-gall. This gall is practically identical with gall no. 47 produced on *Randia curvata*. Gall cavity unilocular containing a single larva inside. Exit hole at lateral side of the gall. Size of the gall varies from 3-4 mm in diameter and 5-10 galls may arise on a single leaf. *R. M. Sharma*, 25.2.1983, 7.3.1983.

Distribution : MIDDLE ANDAMAN : Parnashala, Nimbudera.

CUCURBITACEAE

31. Gall No. 49 : Undetermined plant. *Lasioptera* sp. *New gall*.

Stem gall (Fig. 30). Fusiform, elongated, occasionally subcylindrical, globose/sub-globose, solid, fleshy but moderately hard, indehiscent, persistent swellings of tender branches, longitudinally costate, glabrous, greenish-yellow. Gall cavity unilocular, axial, elongated, narrow, containing many larvae inside. Pupation inside the gall itself. Larvae parasitized by Braconids & Chalcids

(Hymenoptera). One species of Cecidomyiidi breeds in these galls as inquiline. A number of *Dacus cucurbitae* Coq. (Trypetidae) were also bred from these galls, which pupate outside the gall. Mature gall measures upto 45-50 mm long and 15-20 mm thick. *R. M. Sharma*, 15.6.1982, 16.6.1982, 17.1.1983, 18.1.1983, 15.2.1983, 12.12.1983.

Distribution : SOUTH ANDAMAN : Alexandra Island, Wandoor, Havelock Island, Peel Island. MIDDLE ANDAMAN : Kadamtala. NORTH ANDAMAN : Kalipur.

32. Gall No. 50 : Undetermined plant. *Lasioptera* sp. *New gall*.

Stem gall (Fig. 31). Fusiform, elongated, swellings similar to Gall No. 49 described above. *R. M. Sharma*, 15.6.1982, 16.6.1982.

Distribution : SOUTH ANDAMAN : Alexandra Island, Wandoor.

UNIDENTIFIED PLANTS

33. Gall No. 51 : (?) *Kiefferia* sp. (Asphondyliidi), *New gall*.

Leaf/petiole/stem gall (Fig. 32, 33). Mostly hypophyllous sessile, elongated, moniliform, solid, hard, woody, glabrous solitary or agglomerated swellings confined to petiole or midrib in case of leaf gall, globose/subglobose, hard, solid, glabrous, woody indehiscent, persistent cortical gall on tender branches, greenish to light brown when young, brown to dark brown as grow old; Gall cavity unilocular containing many larvae inside. Pupation within the gall itself. Exit hole hypophyllous, lateral in leaf gall. 3-4 exit holes seen on a single mature gall. Size varies from 9-35 mm in length and 5-7 mm in diameter. 1-6 galls arise on a single leaf and 3-4 on a tender branch. *R. M. Sharma*, 16.6.1982.

Distribution : SOUTH ANDAMAN : Wandoor.

34. Gall No. 52 : Cecidomyiidi, midge not identified. *New gall*.

Leaf gall (Fig. 34). Epi-hypophyllous, globose, perfoliate, sessile, solitary, rough,

pulpy, non-localized, shiny, light brown, indehiscent, persistent, pouch-gall, becomes dark brown as grow old; uniformly developed on both the sides of the leaf blade, gall cavity unilocular, enclosing a single whitish larva inside, larvae devoid of sternal spatula, pupation within the gall itself. Chalcids heavily parasitize midge larvae. Exit hole

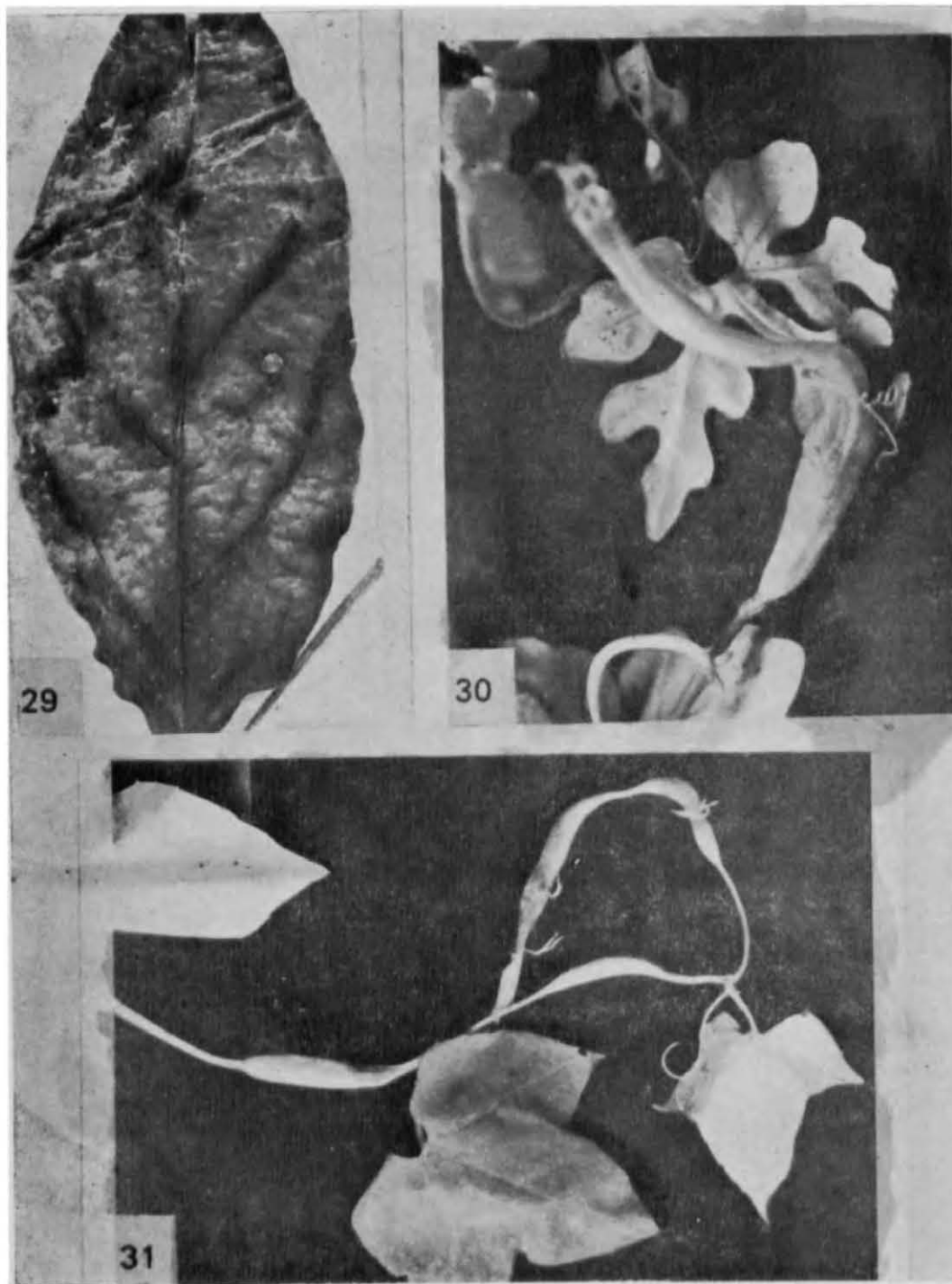


Plate VIII ; Figs. 29-31 : 29. Gall No. 48 on leaf of *Sphenodesme involuata* (Press) Robin. 30. Gall No. 49 on stem of undetermined plant of Cucurbitaceae. 31. Gall No. 50 on stem of undetermined plant of Cucurbitaceae.

hypophyllous. Size varies from 4-7 mm in diameter and 4-5 mm high above leaf surface at both the sides. Number of galls per leaf ranges from 1-5. R. M. Sharma, 21.2.1983, 9.12.1983.

Remarks : *Lasioptera* sp. associated with fungal hyphae also breed in these deserted galls as pointed out in case of gall no. 46 on *Randia curvata*. 'Skuhrava' *et al.* (1984) have explained the symbiotic role of fungi called

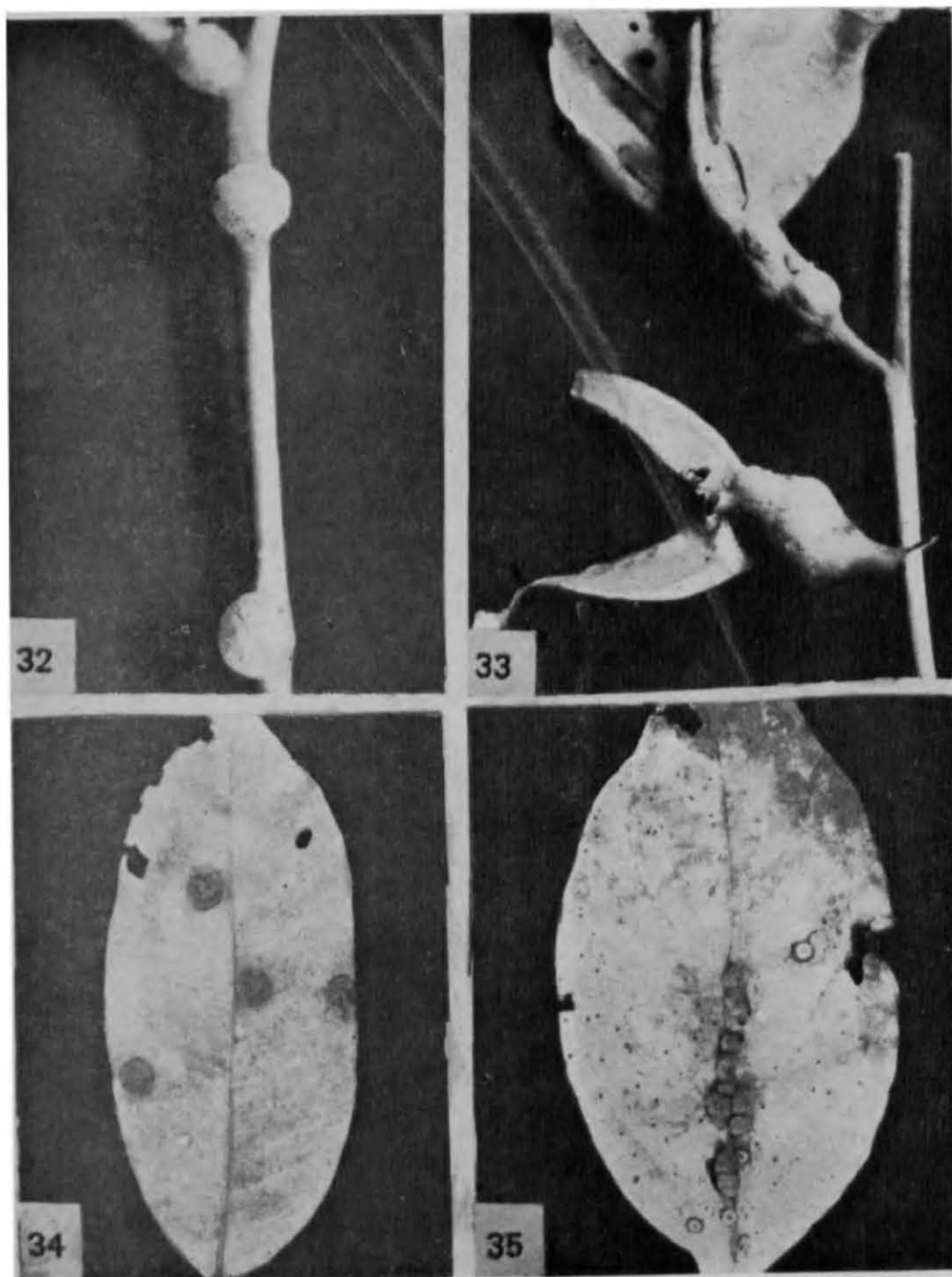


Plate IX : Figs. 32-35 : 32. Gall No. 51 on stem of unidentified plant. 33. Same on petiole/leaf. 34. Gall No. 52 on leaf of unidentified plant. 35. Gall No. 53 on leaf of unidentified plant.

"Ambrosia fungi" which live in association with a number of gall midges mostly belong to the genera *Lasioptera* Meigen and *Asphondylia* H. Loew. The species of fungi are undetermined. Such galls are known as "Ambrosia galls". The symbiotic relationship benefits the gall midge larvae to use a part of the fungi as food and in turn the fungi are benefitted since they live protected inside the plant. Further, midges ensure wide distribution and a favourable host plant for the fungi and keep them away from unfavourable environmental conditions. Therefore, I am inclined to say that gall no. 46 and 52 are the examples of Ambrosia galls in which *Lasioptera* sp. live symbiotically with fungi.

Distribution : MIDDLE ANDAMAN : Bakultala. NORTH ANDAMAN : Smith Island.

35. Gall No. 53 : Adult unknown. *New gall*.

Leaf gall (Fig. 35). Epi-hypophyllous, spherical/subspherical, solid, hard, woody, rough, thick-walled, solitary, paired or 2-4 agglomerated; mostly occur all along the mid rib in a series or non-localized, perfoliate, light to dark brown, indehiscent persistent. Gall cavity unilocular, enclosing a single larva inside. Pupation in the gall itself. Ostiole hypophyllous. Size 3-5 mm in diameter on both the sides of a leaf. As many as 25 galls arise on a single leaf. R. M. Sharma, 22.2.1983.

Distribution : MIDDLE ANDAMAN : Bakultala.

Out of thirty five galls studied here 22 are leaf galls, 6 stems and 7 are inflorescences or flower galls. Key to galls provided here is purely artificial and is given merely to facilitate the provisional identification of galls.

KEY TO GALLS

1. Floral galls	..	2
— Leaf or stem galls	..	4
2. Inflorescence gall on <i>Mangifera</i> or grass ear-heads	..	3
— Flower gall, spherical, solid, hard and corky on <i>Pongamia pinnata</i> (Linn.) Pierre	..	Gall No. 65
3. Galls on inflorescence of <i>Mangifera indica</i> Linn.	..	Gall No. 29
— Galls on ear heads of <i>Axonopus compressus</i> (SW.) P. Beauv. Gall No. 37 ; <i>Bracharia repatens</i> (Linn.) Gardn. of Hubb. Gall No. 38 ; <i>Cyrtococcum accrescens</i> (Trin.) Stapf. Gall No. 39; <i>Digitaria sanguinalis</i> (Linn.) Scop. Gall No. 40 ; <i>Eragrostis unioides</i> (Retz.) Nees ex Steud.	..	Gall No. 41.
4. Stem galls	..	5
— Leaf galls	..	9
5. Galls restricted to stem only	..	6
— Galls not restricted to stem only	..	8
6. Fusiform, fleshy, longitudinally costate galls on tender branches of Cucurbitaceae	..	Gall No. 49 & 50
— Globose/subglobose, hard, woody, galls on other plants	..	7
7. Galls on <i>Parameria laevigata</i> (Juss.) Moldenke.	..	Gall No. 34
— Galls on <i>Mangifera sylvatica</i> Roxb.	..	Gall No. 31
8. Hard, woody, globose galls on stem, elongated on petiole of undetermined plant	..	Gall No. 51
— Solid, greenish, agglomerate mass on stem and petiole of <i>Ventilago madraspatana</i> Gaertn.	..	Gall No. 44
9. Mostly Epiphyllous or Hypophyllous galls	..	10
— Mostly Epi-Hypophyllous galls	..	26
10 Epiphyllous galls	..	11
— Hypophyllous galls	..	21
11. Galls on <i>Mangifera</i> sp.	..	12
— Galls on other plants	..	15

12. Spherical, discoid, or globose pustuloid galls	..	13
— Conical, operculate or globose, spiny galls	..	14
13. Spherical, discoid, depressed, lenticular galls on <i>Mangifera indica</i> Linn., and <i>M. sylvatica</i> Roxb.	..	Gall No. 28 & 33
— Globose, solid, sessile, shiny pustule-like galls on <i>M. indica</i> Linn.	..	Gall No. 69
14. Conical, operculate on lower surface, rostrate and costate on upper surface, gall on <i>M. sylvatica</i> Roxb.	..	Gall No. 30
— Globose/subglobose galls covered with dense spiny whorls look-like miniature sea-urchin on <i>M. sylvatica</i> Roxb.	..	Gall No. 32
15. Discoid, depressed, lenticular or spherical swellings	..	16
— Fusiform, erect, pedicellate or globose/subglobose galls	..	20
16. Discoid, depressed, lenticular galls on <i>Avicennia marina</i> (Forsk.) Vier	..	Gall No. 4
— Discoid, biconvex galls or spherical swellings on other plants	..	17
17. Discoid, biconvex, rugose or smooth galls	..	18
— Spherical swellings	..	19
18. Discoid, biconvex rugose galls on <i>Ficus racemosa</i> Roxb.	..	Gall No. 42
— Discoid, smooth, galls more pronounced on upper surface of <i>Randia curvata</i> (T. & B.) Valet.	..	Gall No. 46
19. Spherical swellings broadly inserted on leaf of <i>Randia curvata</i>	..	Gall No. 47
— Spherical swellings on <i>Sphenodesme involucrata</i> (Presl.) Robins.	..	Gall No. 48
20. Fusiform, erect, pedicellate, operculate, stout, thickwalled galls on <i>Gnetum acutum</i> Markgr.	..	Gall No. 15
— Globose/subglobose, sessile, solitary galls on <i>Amoora wallichii</i> King	..	Gall No. 43
21. Galls on leaf surface	..	22
— Galls on midrib or lateral veins	..	24
22. Globose/subglobose galls on <i>Avicennia marina</i> (Forsk.) Vier.	..	Gall No. 3
— Pyxidial/barrel shaped galls	..	23
23. Galls on <i>Randia curvata</i> (T. & B.) Valet	..	Gall No. 45
— Galls on <i>Avicennia marina</i> (Forsk.) Vier.	..	Gall No. 6
24. Globose/subglobose, large sized galls on midrib or one of the lateral veins	..	25
— Elongated, oval galls only on midrib of <i>Avicennia marina</i> (Forsk.) Vier.	..	Gall No. 8
25. Globose/subglobose galls with smooth surface on <i>Gnetum acutum</i> Markgr.	..	Gall No. 36
— Globose/subglobose galls with rough surface on <i>Phaeanthus andamanicus</i> King	..	Gall No. 17
26. Galls arise on leaf surface	..	27
— Galls arise on petiole/midrib or one of the lateral veins	..	29
27. Spherical, lenticular, swellings well marked on upper surface of leaf	..	28
— Globose/subglobose, pulpy, shiny, well marked swellings equally developed on both surfaces of leaf on undetermined plant.	..	Gall No. 52
28. Spherical swellings on <i>Parsonia alboflavescens</i> (Dennst.) Mabberly	..	Gall No. 35
— Spherical swellings on undetermined plant of Apocynaceae	..	Gall No. 61
29. Globose/subglobose, solid, hard, dark green agglomerate mass all along the midrib or one of the larger lateral veins on <i>Vrtilago madraspatana</i> Gaertn.	..	Gall No. 44
— Globose/subglobose, solid, hard, woody light to dark brown galls all along the midrib in a linear series or non-localized on undetermined plant	..	Gall No. 53

SUMMARY

The present paper deals in detail with exomorphic description and pictorial representation of 35 midge galls on 24 plant species collected from 25 different localities of South, Middle and North Andaman Islands during 1981-83. Of these 35 galls 22 arise on leaf, 6 on stems and 7 on inflorescences or flowers.

All these midge galls are new records for Andamans, while 27 are new to the Indian Plant galls. The actual number of midge galls inhabiting the archipelago is certainly much higher than the one reported here and further explorations will definitely yield a rich diversity of galls. Key and gall-index are also provided for the provisional identification of the galls dealt here.

GALL INDEX

Gall No.	Host plant	Gall-midge species/group	Plant part bearing the gall
43	<i>Amoora wallichii</i>	Adult unknown	Leaf
3	<i>Avicennia marina</i>	<i>Brachyneura</i> sp.	Leaf
4	<i>Avicennia marina</i>	Lasiopteridi	Leaf
6	<i>Avicennia marina</i>	Lasiopteridi	Leaf
8	<i>Avicennia marina</i>	<i>Brachyneura</i> sp.	Leaf/midrib
37	<i>Axonopus compressus</i>	<i>Lasioptera</i> sp.	Ear-heads
38	<i>Brachiaria reptans</i>	<i>Lasioptera</i> sp.	Ear-heads
39	<i>Cyrtococcum accrescens</i>	<i>Lasioptera</i> sp.	Ear-heads
40	<i>Digitaria sanguinalis</i>	<i>Lasioptera</i> sp.	Ear-heads
41	<i>Eragrostis unioides</i>	<i>Contarinia eragrostidis</i> Felt.	Ear-heads
42	<i>Ficus racemosa</i>	<i>Cystiphora</i> sp.	Leaf
15	<i>Gnetum acutum</i>	<i>Asphondylia</i> sp.	Leaf
36	<i>Gnetum acutum</i>	Asphondyliidi	Leaf/midrib
28	<i>Mangifera indica</i>	<i>Procontarinia matteina</i> Keiffer & Cecconi	Leaf
29	<i>Mangifera indica</i>	<i>Procytiphora indica</i> Grover & Prasad.	Flower buds
69	<i>Mangifera indica</i>	Adult unknown	Leaf
30	<i>Mangifera sylvatica</i>	Adult unknown	Leaf
31	<i>Mangifera sylvatica</i>	Adult unknown	Shoot axis/leaf
32	<i>Mangifera sylvatica</i>	Adult unknown	Leaf
33	<i>Mangifera sylvatica</i>	Adult unknown	Leaf
34	<i>Parameria laevigata</i>	Adult unknown	Stem
35	<i>Parsonia alboflavescens</i>	Adult unknown	Leaf
17	<i>Phaeanthus andamanicus</i>	<i>Asphondylia</i> sp.	Leaf
65	<i>Pongamia pinnata</i>	<i>Asphondylia pongamiae</i> Felt (?)	Flowerbuds
45	<i>Randia curvata</i>	<i>Polystepha</i> sp.	Leaf
46	<i>Randia curvata</i>	Cecidomyiidi	Leaf
47	<i>Randia curvata</i>	<i>Polystepha</i> sp.	Leaf
48	<i>Sphenodesme involucrata</i>	Adult unknown	Leaf
61	Unidentified plant of Apocynaceae	Adult unknown	Leaf
49	Unidentified plant of Cucurbitaceae	<i>Lasioptera</i> sp.	Stem
50	Unidentified plant of Cucurbitaceae	<i>Lasioptera</i> sp.	Stem
51	Undetermined plant	<i>Kiefferia</i> sp.	Stem/leaf/petiole
52	Undetermined plant	Cecidomyiidi	Leaf
53	Undetermined plant	Adult unknown	Leaf/midrib
44	<i>Ventilago madraspatana</i>	Adult unknown	Stem/leaf/petiole

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