THE CUCURBIT GALL MIDGE, *LASIOPTERA CHICHINDAE* GROVER (DIPTERA : CECIDOMYIIDAE) AND ITS POSSIBLE CONTROL

S. FAHEEMAH M. SULAIMAN
Regional Agricultural Research Centre
Makandura, Gonawila (NWP)

ABSTRACT

Gall formation by the cucurbit gall midge, *Lasioptera chichindae* Grover, was observed on vines of snakegourd, *Trichosanthes cucumerina* L., in small vegetable holdings on the regosols of Kadirana in the Katana area. This pest formed galls on all parts of the vine. The midge was collected, identified and its biology studied. This species did not affect bittergourd in the immediate vicinity. As the developmental stages of the midge are found in galls within the growing vine, the affected crop should be destroyed by burning or deep burial at the end of harvest. Crop sanitation within the field, crop rotation and organized synchronous planting in that area could effectively keep midge numbers down.

KEY WORDS : Cucurbit, *Lasioptera chichindae*, Snakegourd

INTRODUCTION

Snakegourd (*Trichosanthes cucumerina* L.) is a popular vegetable crop grown in small holdings on the regosols of Kadirana in the Katana area. Recently it was found that snakegourd yields in this area were adversely affected by gall formation on the vines. The causal agent was identified to be a gall-forming insect, *Lasioptera chichindae* belonging to the family cecidomyiidae. This pest has not been recorded previously by the Sri Lanka Department of Agriculture. Literature review showed that this species was identified for the first time in 1965 in Allahabad (India) by Grover (1965) as *Bimba chichindae* on the same host. Grover (1965) has described the taxonomic details of the adult midge. However, the biology of this midge or of its relatives is unknown. Most of the information available on these gall midges are in the form of monographs and catalogues of classification (Gagne, 1973).

In the present study it is not intended to describe the taxonomic details of the adult midge; instead the biology of the midge was studied and illustrated, Also possible cultural control measures against this pest have been recorded so that frequent applications of insecticides on the crop could be reduced.

MATERIALS AND METHODS

Galls were collected from farmers fields and left for adult emergence on potted snakegourd plants under caged conditions. Some of the galls were also left to emerge in the field where some snakegourd plants were established. Dates of adult emergence from these galls were observed. Dates of gall formation on the new plants were also noted and these areas tagged for observations like increase in girth of stem and duration taken for the gall to mature. The dates of adults emerging from these galls were also recorded.

Some of the adults that emerged were killed using vapona strips, mounted dry and sent to the United States Department of Agriculture (USDA) for identification. For microscopic studies of developmental stages, galls at various stages were fixed either in Formol-calcium solution (mixture of 10 ml of formalin, 1 g of anhydrous $CaCl_2$ and 90 ml of water) or in 70% alcohol and dissected carefully to extract the larval and pupal stages of the midge. These specimens were washed, stained with alum-carmine solution, dehydrated through a series of alcohol, cleared in clove oil and mounted in canada-balsom.

The larval and pupal stages from these slide preparations were sketched using a stereo-binocular microscope with a drawing tube attachment.

For longevity studies, some galls were left to emerge under a mylar film cage (55 cm tall with 'circular mesh top' of 14 cm diameter) enclosing a single potted plant of snakegourd. After the emergence of one set of midges under the first cage, the remaining galls (containing unemerged midges within) were transferred to a similar fresh cage to allow emergence of a second set of adults and this was continued until five sets of adults emerged in five different cages each time. In

each cage the date of adult emergence was first noted and thereafter the survival period of the adult midge was recorded. This experiment was replicated at least four times.

RESULTS AND DISCUSSION

Damage

The pest affected all parts of the vine and therefore galls were formed in the node, internode, petiole, axillary bud or floral bud, tendrils, leaf blade, leaf vein and the growing apical stem (Fig. 1). The galls were of varying thicknesses and sizes depending on the varying number of larvae developing within the gall. Regular ovoid, spindle-shaped or bead-like, local or sub-extensive, solid, hard, fleshy tuberous swellings of various parts of the vine were observed. These galls were pale green in colour and indehiscent. The normal growth of the vine was interrupted and affected parts of the plants were stunted. In the axils, male flowers as well as female flowers were galled. Female flowers were also galled soon after fruit set, and therefore the fruit did not grow to its normal size (Fig. 1). Galls being physiological sinks caused yield loss.

Life history of the midge

Comparing the adult insect with *Lasioptera falcata* from bittergourd, it was initially guessed to belong to the genus *Lasioptera*. It was later identified as *Lasioptera chichindae* (Fig. 2) by R. J. Gagne of USDA in May 1987, indicating that nothing was known about the biology of the fly or of its relatives on cucurbitaceae. Gagne (1973) classified this midge under the sub-family cecidomyiidae and super-tribe lasiopteridi.

During the present study, eggs of the midge were not observd on the surface of the plant tissue; probably the eggs are inserted into the soft plant tissues of the vine by the ovipositor of the adult female. First symptoms of galling was noticed about 10 days after adult midge infestation. At this stage larval development had already commenced. From this stage development proceeds for a further 16–18 days within the gall before the gall matures and adults emerge.

During development the larvae feed and bore their way through the plant tissue by the use of the "breast bone" or sternal spatula (Fig. 3), a characteristic feature of the cecidomyiidae (Imms, 1948). The functions of the sternal spatula reported by Imms (1948) are as follows:

* an organ of perforation used for abrading plant tissues
* as a locomotary organ
* as an organ for changing the position of the larva in its pupal case

Complete larval and pupal (Fig. 4) development took place within the galls and the adult midge emerged leaving the empty pupal exuvium protruding out from the surface of the gall (Fig. 5). From each gall several such exuvia were observed to be sticking out from emergence holes, showing that more than one midge developed within each gall. The duration for the complete life cycle ranged from 23—31 days, with 66% of total insects completing development within 27—28 days. The mean duration taken to complete the life cycle of the insect was 27.19 days (variance = 1.59, total number of insects studied = 104). Longevity studies showed that the midge lived for about 2—3 days.

In the farmers' fields adjacent vines of bittergourd *Mormodica charantia* were unaffected by this species, showing *L. chichindae* to be specific to snakegourd while *L. falcata* Felt is reported to be specific to bittergourd (Felt. 1919 as quoted by Barnes,1946).

It is reported that Felt described over 400 species of cecidomyiidae which formed galls on nearly 200 genera of plants (Carter, 1973). The nature and cause of the stimulus for gall formation has been speculative. It is reported that larval development within the gall provided the continuing stimulus to gall formation (Plumb, 1953, as quoted by Carter, 1973). Miles (1968) concluded that indole acetic acid (IAA) was the universal cause of cecidogenesis or gall formation. However, the most rapid and sustained growth of galls was obtained when a mixture of IAA (10 mg/l), adenine (50mg/l) and kinetin (10 mg/l) was injected (McCalla *et al.*, 1962, as quoted by Carter, 1973).

Control

An awareness of the pest biology, ecology and host plant preferences could enlighten us on the control measures that need to be adopted. Since *L. chichindae* is specific to *T. cucumerina* crop rotation with other gourds or vegetable crops could keep midge numbers down. The entire developmental period (more than 90% of its life cycle) of the midge is spent within galls of the growing vine. Therefore, integration of the following control measures could reduce pest numbers:

* destruction of affected vines by burning or deep burial after harvest
* time to time pruning and destruction of affected parts of the standing vine through regular surveillance of pest damage

Field collected galls did not show the emergence of any parasites. So, its natural enemies may not be within our shores. Staggered planting of this crop in a haphazard manner could aggravate the problem in case the natural enemies of the pest do not occur here. On the other hand, organized synchronous planting and harvest by farmers within that area or leaving land fallow of the snakegourd crop for at least six months in that area could help to minimize this pest problem in affected fields to manageable levels. Normal farmer practice of using affected vines to mulch a banana crop in the vicinity should be discouraged. Chemical control measures are expensive and are not totally effective since the developmental stages of the insects are well protected within the galls.

ACKNOWLEDGEMENTS

Laboratory facilities provided by Professor W. R. Breckenridge, Head, Department of Zoology. University of Peradeniya and technical assistance given by Mr. Lional Pereira of the same department are gratefully acknowledged.

REFERENCES

Barnes, H. F. 1946. Gall midges of economic importance. Vol. I. Gall midges of root and vegetable crops. Crosby Lockwood and Son Ltd., London. 104 p

Carter. W. 1973. Insects in relation to plant disease. John Wiley and Sons, New York. 759 p.

Gagne, R. J 1973. Family Cecidpmyiidae. *In* Catalog of the Diptera of the Oriental Region. Vol. I. Suborder - Nematocera, Eds. Mercedes D. Delfinado and D. Elmo Hardy. pp 480 - 517. University Press, Hawaii, USA.

Grover, P. 1965. Studies on gall midges from India. XIII. New genus *Bimba* and its four new species. Marcellia 32 : 247 - 263.

Imms, A. D. 1948. A general textbook of entomology. E. P. Dutton and Co., New York. 727 p.

Miles. P. W. 1968. Insect secretions in plants. A. Rev. Phytopath. 6 : 137 - 166.

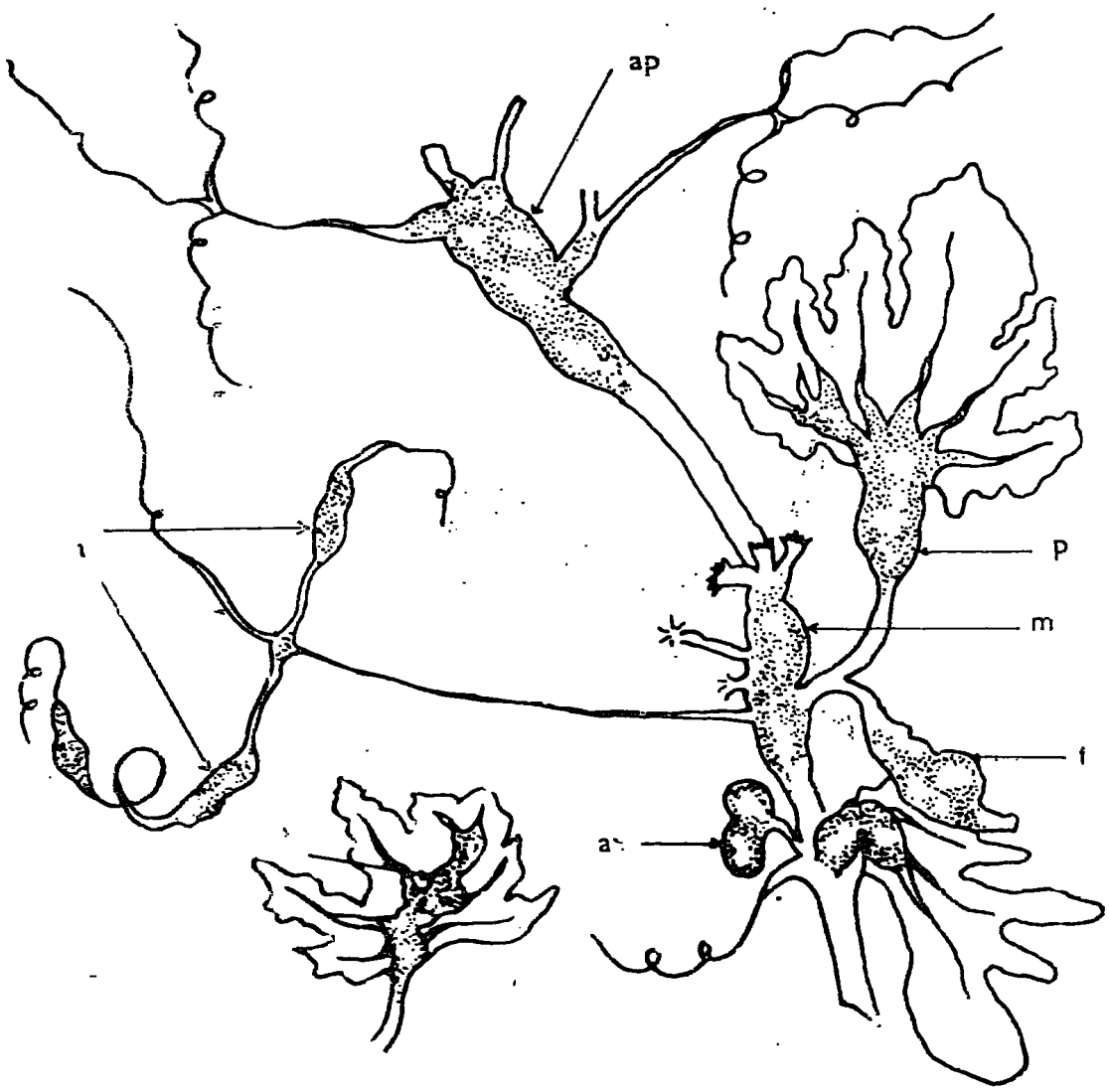

Fig. 1. Part of snakegourd vine showing galled apical stem (ap), axillary bud (ax), female flower after fruit set (f), male flowers (m), petiole (p), tendril (t), and vein (v)

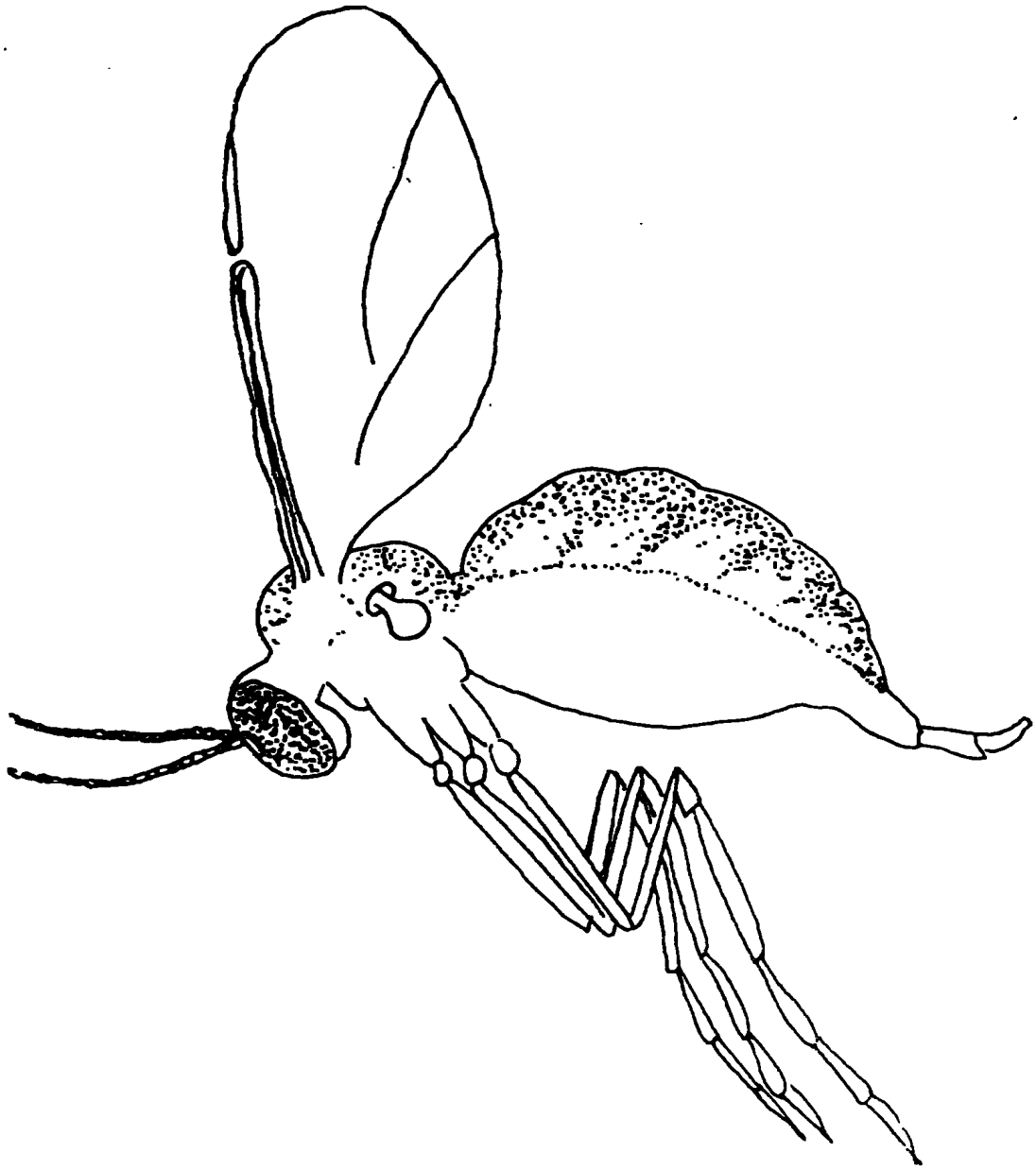

Fig. 2. *Lasioptera chichindae*, female adult midge (magnification $\times 2.5 \times 10$)

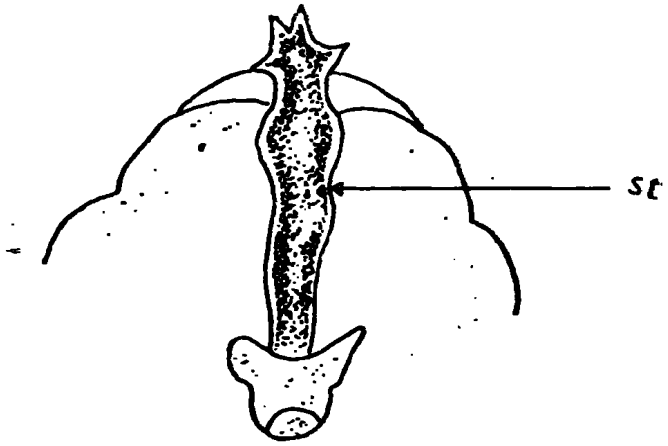

Fig. 3. Anterior thorax of larval stage showing sternal spatula (st) (magnification $\times 10 \times 10$)

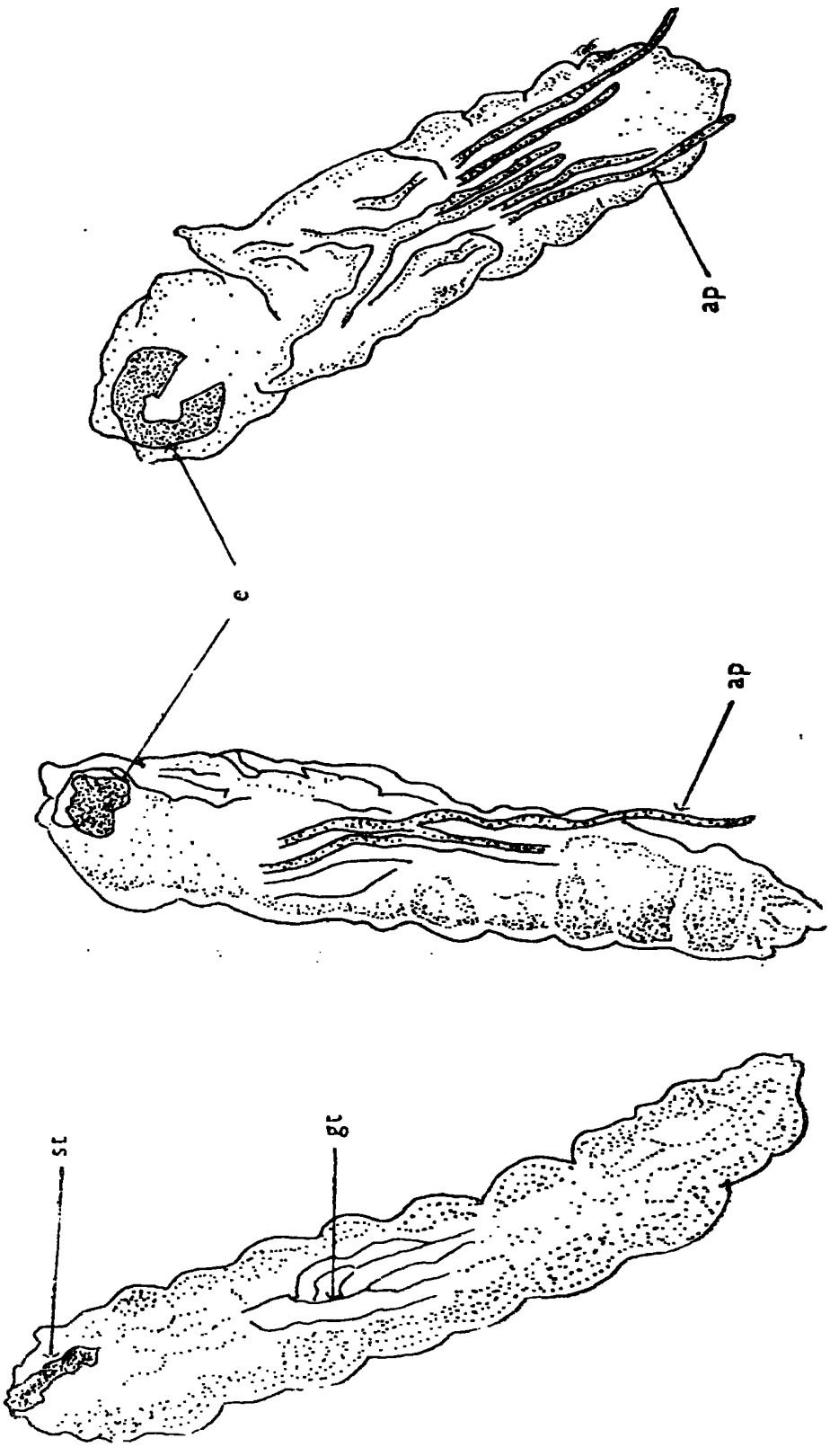

Fig. 4. Developmental stages of *Lasioptera chichindae*] (magnification × 3.5 × 10). A=larval stage; B—1=pupal stage (lateral view); B—2=pupal stage (ventral view). st=sternal spatula; gt=gut; e=eye; ap=appendage

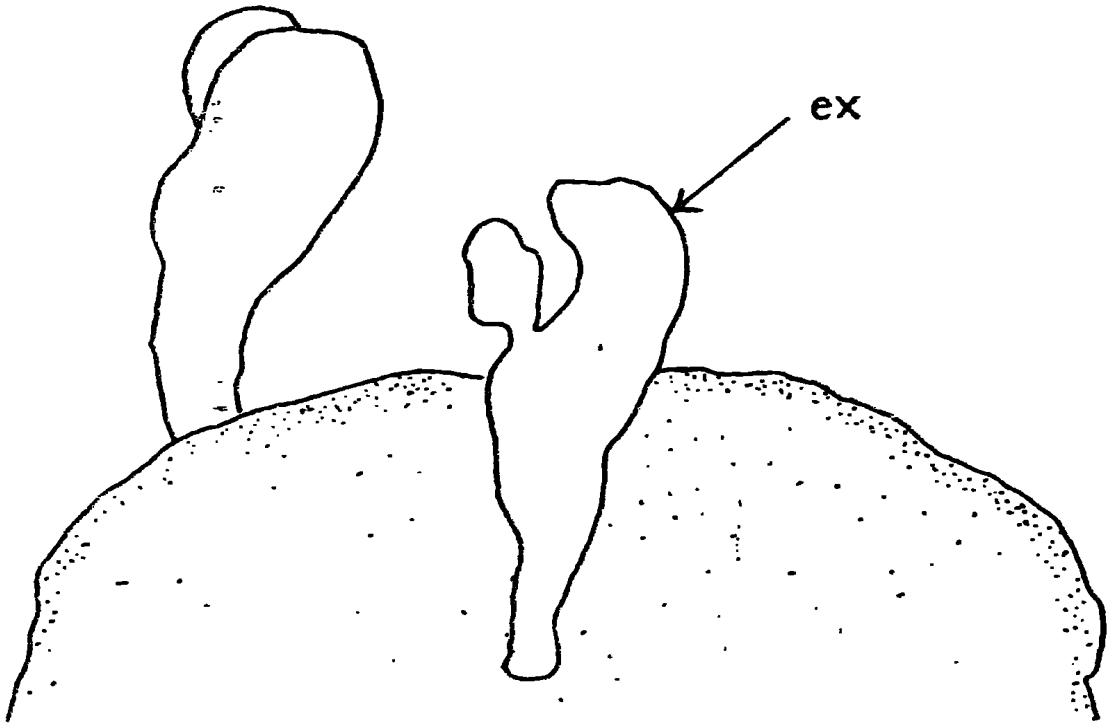

Fig. 5. Part ot gall showing empty pupal exuvia (ex) after emergence of adult midge (highly magnified)