successively overlapping stratified layers, fill each protoplasmic protrusion (Fig. 2 D). It is interesting to note that the three protoplasmic protuberances in either 3-colporate or 3-porate pollen morphotypes are uniformly developed in a grain (Fig. 1) although usually only one of the germinal tubes would elongate later[2-4] to function as the channel for the generative nucleus to move and fertilize the female counterpart.

The function of these protoplasmic protuberances is not very clear. With the initiation of pollen tube formation the protoplasm flows out into it and in case such a phenomenon takes place before the pollen reaches the stigma the protoplasm would be open to the risk of the ill-effects of the environment. The protuberance-like structure appears to act like a cap on the protoplasm arresting its movement consequent to the initiation of pollen tube. This is confirmed by the fact that the protoplasmic protuberances do not occur where there is no pollen tube initiation.

I record my gratefulness to Dr. Dalbir Singh, University of Rajasthan, Jaipur, for guidance and to Dr. S. D. Gupta, Principal, for providing necessary facilities.

Department of Botany, S. DHAR.
Government Post-Graduate College,
Sriganganagar (Raj.),
February 16, 1973.

1. Nair, P. K. K., *Pollen Morphology of Angiosperms*, Delhi, 1970.
2. Kirkwood, J. E., *Bull. Torrey bot. Cl.*, 1907, 34, 221.
3. Nair, P. K. K. and Deshpande, S. U., *J. Palynol.*, 1968, 4, 98.
4. Singh, D., *Bull. Indian nat. Sci. Acad.*, 1970, 41, 212.

ON ENDOTHECIAL THICKENINGS IN SOME MONOCOTYLEDONOUS FAMILIES

GENERALLY endothecium is designated as 'fibrous' though it shows variable nature in different families. Untawale[6], while studying the embryology of Cyperaceae noticed that the endothecial thickenings in this family are in the form of definite spirals unlike the previous reports of Davis[1], Khanna[3], Padhye[4] and Shah[5]. However, Eames[2] has discussed about different types of endothecial thickenings in several families of angiosperm. This created an interest to study the variations in the endothecial thickenings in other monocotyledonous families also.

Mature anthers, preserved in 70% F.A.A., were crushed in maceration fluid (con. nitric acid + pot. chlorate) and washed thoroughly in water. Finally this material was stained with phloroglucinol, treated with dil. hydrochloric acid and mounted in glycerin.

During present investigation the following types of endothecial thickenings were observed in 30 different species of 29 genera belonging to 16 families of monocotyledon.

I. *Spiral Type*:

(*i*) *Cyperus type*.—This type is characterized by the presence of definite spirals in all endothecial cells. In Cyperaceae and Juncaceae the spirals are of thin bands, whereas they are thick in Cannaceae, Hemodoraceae and Amaryllidaceae.

The compactness of these bands show variation in different genera. In *Canna indica, Allium cepa, Iris reticulata* and *Polyanthus tuberosa* the spirals are loosely arranged, while in most of the members of the Cyperaceae, Juncaceae, Palmaceae, Hemodoraceae, Liliaceae and Typhaceae they are more compact.

(*ii*) *Musa type*.—Basically this is a spiral type of thickening present in the family Musaceae. It shows little variation from the main spiral type. Every alternate row of endothecial cell develops a thickening in the form of annular rings. These cells when observed from above look like a chain of rings. It is interesting to note that these rings are made up of spirals having only two coils. Because of their ribbon-like nature and compactness it is difficult to differentiate the spiral nature of these rings.

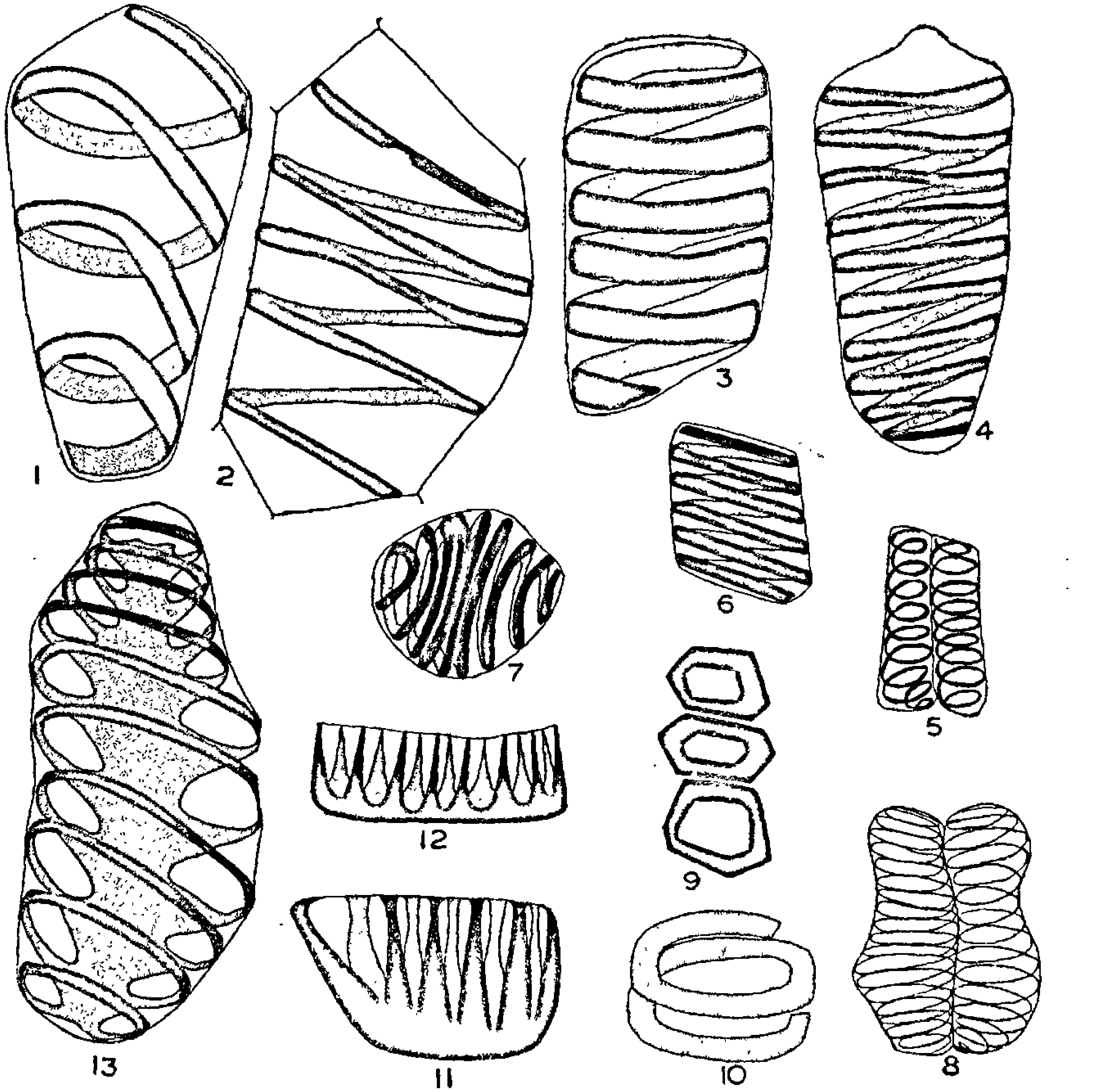
II. *Girdle Type*:

(*i*) *Grass type*.—This type of thickening was observed in two families studied here, *i.e.*, Gramineae and Eriocaulaceae. During development the lignacious thickening forms a plate-like structure at the base from which finger-like projections grow in upward direction. These projections are free from each other and also at the apex.

(*ii*) *Sagittaria type*.—This type of thickening is seen in only *Sagittaria* sp. amongst the members investigated here. General pattern of this type of thickening is almost same as the "grass type" except the difference that in *Sagittaria* type, ends of the finger-like projections are fused and thus form a continuous girdle-shaped band.

showin in Table I on the basis of above observations.

From Table I it is seen that Cyperus type of thickening of spiral nature is predominant in the members investigated here. Present study is confined to only monocotyledonous species available locally. However, it will be worthwhile to study this character in different species belonging to several other families also. Further it will be interesting to study the development and the working of these endothecial thickenings.



FIGS. 1–13. Endothecial thickenings in different species of monocotyledons. Fig. 1. *Canna indica* L. Fig. 2. *Iris reticulata*, Fig. 3. *Sansevieria zeylanica* Willd. Fig. 4. *Caryota urens* L. Fig. 5. *Typha angustata* Bory. Fig. 6. *Asparagus recemosus* Willd. Fig. 7. *Eulophia pratensis* Lindl. Fig. 8. *Juncus lampocarpus* L. Fig. 9. *Musa paradisiaca* L. Fig. 10. *Musa* sp.—a single spiral. Fig. 11. *Cymbopogon citratus* L. Fig. 12. *Eriocaulon lanceolatum* Miq. Fig. 13. *Sagittaria sagitifolia* L. (All figures, × 300).

Distribution pattern of the endothecial thickenings in different families of monocotyledons is

TABLE I

No.	Family	Plant	Type of thickening
1.	Hydrocharitaceae	*Hydrilla verticillata* Persl.	Cyperus
2.	,,	*Vallisnaria spiralis* L.	,,
3.	Orchidaceae	*Habenaria* sp.	,,
4.	,,	*Eulophia pratensis* Lindl.	,,
5.	,,	*Vanda parviflora* Lindl.	,,
6.	Cannaceae	*Canna indica* L.	,,
7.	Musaceae	*Musa paradisiaca* L.	Musa
8.	Hemodoraeeae	*Sansevieria zeylanica* Willd.	Cyperus
9.	Iridaceae	*Iris reticulata* Bieb.	,,
10.	Amaryllidaceae	*Polyanthus tuberosa* L.	,,
11.	Asparagaceae	*Asparagus racemosus* Willd.	,,
12.	Liliaceae	*Allium cepa* L.	,,
13.	,,	*Gloriosa superba* L.	,,
14.	,,	*Scilla indica* Bak.	,,
15.	Palmaceae	*Areca catechu* L.	,,
16.	,,	*Phoenix sylvestris* Roxb.	,,
17.	,,	*Cocos nucifera* L.	,,
18.	,,	*Hyphanae indica* L.	,,
19.	Eriocaulaceae	*Eriocaulon lanceolatus* Miq.	Grass
20.	Cyperaceae	*Cyperus alternifolius* Linn.	Cyperus
21.	,,	*Eleocharis geniculata* Roem et Schult.	,,
22.	,,	*Rhynchospora wightiana* Steud.	,,
23.	,,	*Sleria stocksiana* Boeck.	,,
24.	Graminae	*Cynodon dactylon* Pers.	Grass
25.	,,	*Eragrostis unioloides* Nees.	,,
26.	,,	*Andropogon schoenanthus* Linn.	,,
27.	Juncaceae	*Juncus glaucus* Ehrh.	Cyperus
28.	,,	*J. lampocarpus* L.	,,
29.	Typhaceae	*Typha angustata* Bory.	,,
30.	Alismataceae	*Sagittaria sagittifolia* L.	Sagittaria

We are grateful to Prof. L. B. Kajale for suggesting the problem and encouragement. Our sincere thanks are also due to Prof. V. Puri, Meerut University, Meerut, for kindly going through the manuscript.

Department of Botany, ARVIND G. UNTAWALE.*
Nagpur University, R. K. BHASIN.
Nagpur, *February* 21, 1973.

* Present address: National Institute of Oceanography, Panaji, Goa.

1. Davis, G. L., *Systematic Embryology of the Angiosperms*, New York, 1966.
2. Eames, A. J., *Morphology of Angiosperms*, New York, 1961.
3. Khanna, P., *Canad. J. bot.*, 1965, 43, 1539.
4. Padhye, M. D., *Ph.D. Thesis*, Nagpur University, 1967.
5. Shah, C. K., *Plant Embryology Symposium*, C.S.I.R., New Delhi, 1962, p. 81.
6. Untawale, A. G., *Ph.D. Thesis*, Nagpur University, 1970.

POST-INFECTION CHANGES IN ASCORBIC ACID CONTENT IN FRUITS OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) INDUCED BY *CYLINDROCLADIUM SCOPARIUM* MORGAN

ASCORBIC acid is widely required in metabolism. Its deficiency is known to produce scurvy in human beings. Tomato has been found to be an important source of vitamin C. Its biosynthesis in plants has been extensively reviewed by Isherwood and Mapson[1].

Cylindrocladium scoparium causes a serious rot of tomato fruits during post-harvest phase. An attempt has, therefore, been made to study the influence of this organism on the ascorbic acid content of the tomato fruits. Mature tomato fruits of nearly same age and size of red-current variety were inoculated with *C. scoparium* and incubated at $25 \pm 2°$ C. Another set of uninoculated fruits treated in a similar manner simultaneously served