FIRST REPORT OF *CYLAS FORMICARIUS* F ON BLACK PEPPER, *PIPER NIGRUM* L

A. M. RANJITH
Regional Agricultural Research Station, Pilicode 670 353. Kasargod, India.

DURING the summer months of 1983–84, yellowing and drying of the vines of black pepper, *Piper nigrum* L, was noticed at the Regional Agricultural Research Station, Pilicode. Yellowing started on the leaf tips, progressed through the leaf margin, the interveinal regions and then the whole leaf, and in one month the leaves dried and fell off. The infestation was generally more pronounced on the orthotrops (main vine) and was less on the plageotrops (fruiting branch). Nevertheless, once the symptoms developed in a vine, the whole vine dried up within two or three months, leaving only the basal portions about one foot above the ground. After the onset of monsoon rains, the basal undried portions started sprouting from the nodes and fresh shoots developed.

The damages to the vines were due to the attack by the sweet potato weevil, *Cylas formicarius* F. The eggs were thrust inside the internodal portions of the vines. They hatched inside the vine and the larvae fed on the internal tissues of the vine. Extensive damage to the vascular tissue, the secondary xylem elements and the medullary rays were noticed leaving just the cortical region and the cork tissue unattacked. The larvae tunnelled upwards, to the terminal regions of the vine, chewing out the internal tissues into frass and causing a stoppage of the sap flow. The larval period lasted for one month and they pupated at the nodes.

In contrast to the attack on sweet potato where the tubers and the vines adjoining the soil are attacked, in the case of pepper, portions of the vine up to one foot from the ground are sparingly infested. The grubs did not show any specific preference to any of the varieties cultivated in the locality. Application of 25 g of Furadan 3 G (carbofuran 0.75 g) at the basins of the vines effectively controlled further damage to the vines. After the absorption of the chemical by the plant, the grubs died inside the larval tunnels.

7 December 1984; Revised 29 April 1985

RESIDUAL MERCURY CONCENTRATION IN BRAIN, LIVER AND MUSCLE OF CONTAMINATED FISH COLLECTED FROM AN ESTUARY NEAR A CAUSTIC-CHLORINE INDUSTRY

B. P. SHAW, A. SAHU and A. K. PANIGRAHI
Department of Botany, Berhampur University, Berhampur 760 007, India

THE use of elemental mercury in caustic-chlorine industry and subsequent discharge of the waste creates widespread environmental problems[1]. The mercury concentration in plants, soil and water around a caustic-chlorine industry and its toxicological significance was reported earlier[2]. Reports pertaining to residual mercury level in waterbodies, soil, vegetation around the chlor-alkali industries and aquatic animals present near the discharge sites[2-8] were available. Very little information was however available pertaining to the residual mercury level in fishes collected from contaminated areas. The location of caustic-chlorine industry near the Rushikulya river estuary, Ganjam, Orissa (30 km away from Berhampur) (figure 1) and the reports[2,3,8,9] that the effluent channel of the industry containing high

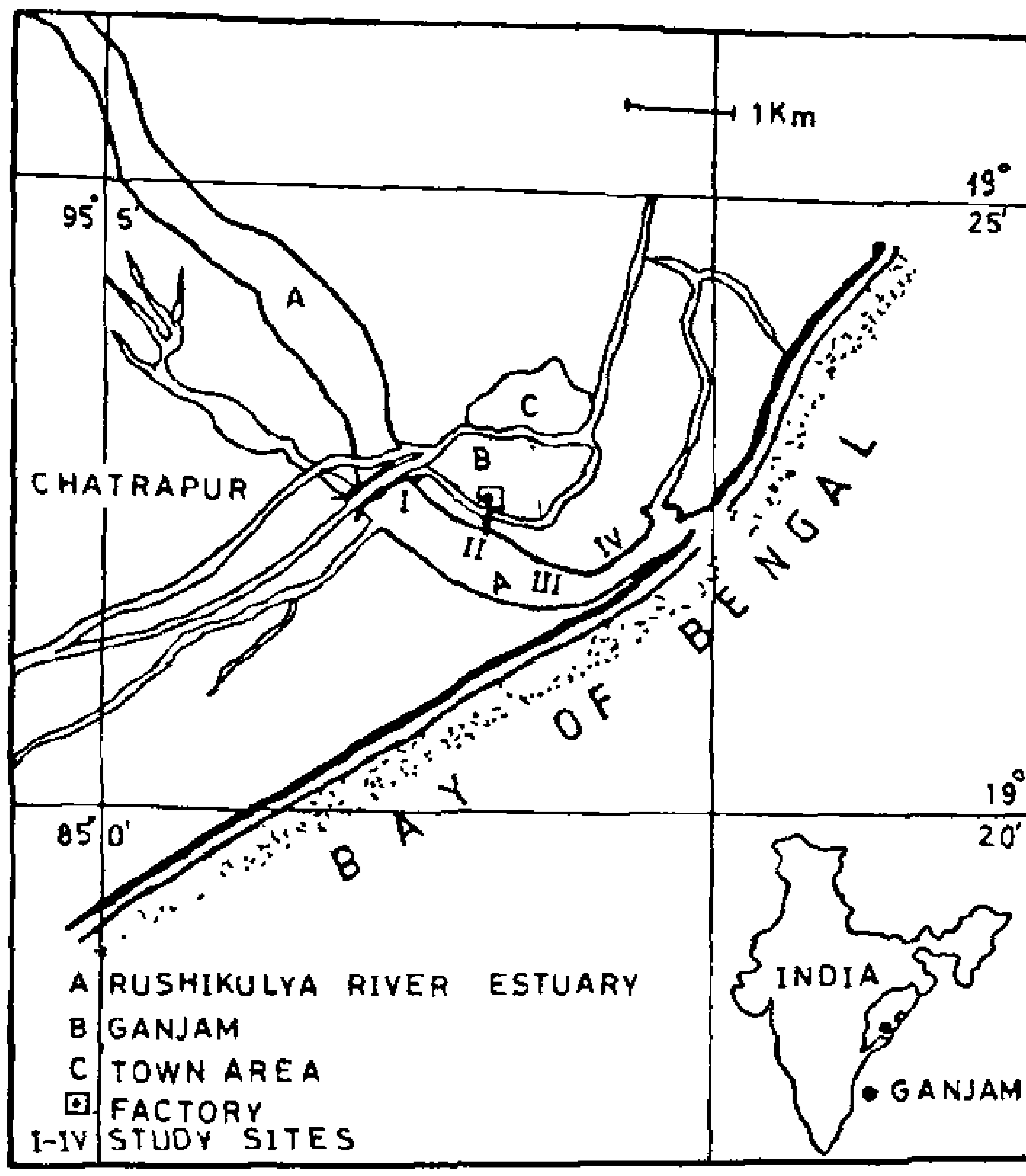

Figure 1. Location of Ganjam area and chlor-alkali industry.

amount of mercury joining the estuary, enabled the authors to carry out the present piece of work, designed to study the residual mercury level in brain, liver and muscle tissues of fishes collected from the contaminated estuary.

Fishes were sampled from the contaminated estuary. Eleven different fishes of different age groups were collected for residual analysis. All the samples were brought to the laboratory in sealed containers. Brain, liver and muscle tissues were separated carefully after autopsy. Samples were weighed and digested in Bethge's apparatus with an acid mixture (1:3 conc. H_2SO_4 and conc. NHO_3). Residual mercury concentration measurements were made in a mercury analyser (ECIL MA5800A). Mercury levels were expressed as mg kg^{-1} fresh fish. All the data were statistically analysed.

Table 1 gives the residual mercury level in brain, liver and muscle of different types of fishes. Small fishes *Arius nenga* accumulated (5 + 0.05 mg kg^{-1} fresh wt) high amount of mercury when compared to bigger fishes and other types of fishes. Residual mercury level in the brain is at higher level in bigger fishes. No specific trend in accumulation of mercury in different tissues was marked. No significant correlation exists between the size of the fish and residual mercury accumulation in the tissue of different fishes. Total mercury content of *Squalus acanthias* sampled in the Strait of Georgia reached levels of 0.5 mg kg^{-1} at fish lengths of 72 and 77 cm for male and female, respectively[10]. The reason for the difference in mercury content between males and females was not fully understood by the authors[10]. As mercury has been shown to be cumulative with age in some fish species[11], it may reflect a difference in growth rate. The residual mercury level in brain, liver and muscle tissue of fishes in the estuarine zone was due to the effluent of the caustic-chlorine factory, which enhances the mercury content of the water. The same conclusion has also been reported by other workers[10,11]. The differential residual accumulation of mercury in different fish (table 1) was due to differential uptake by different fishes [10]. Several workers[12,13] reported that mercury content in liver and muscle tissues increases significantly with the age of fishes. However, such a trend was not observed in our study. Bigger fishes accumulated less mercury than the smaller fishes, probably due to the fact that small fishes have the high rate of metabolism and with the increase in size and age the rate of metabolism declines gradually[8,9]. In addition, small fishes can adjust better than the big fishes in contaminated environments. It is still unclear whether accumulation of mercury through food chain is an important mechanism as assumed by other workers. It has been reported[7-9,14] that with increase in exposure period, the residual mercury level increases in brain, liver and muscle tissue of fishes.

The local inhabitants of the Ganjam area depend on

Table 1 *Mercury content in some fishes collected from Rushikulya river river estuary at Ganjam, Orissa.*

Name of the fishes	Sample size	Length in cm (average)	Mercury conc. in mg kg^{-1} fresh weight		
			Muscle	Liver	Brain
Trachinocephalus myops.	3	23.5	0.42 ± 0.02	0.94 ± 0.13	1.89 ± 0.19
Mugil macrolepis.	5	10.5	0.26 ± 0.03	0.79 ± 0.1	1.15 ± 0.18
	7	19.0	0.14 ± 0.01	0.17 ± 0.02	0.39 ± 0.05
	6	28.25	0.06 ± 0.01	0.06 ± 0.01	0.34 ± 0.05
Mystus vittatus.	4	12.75	1.74 ± 0.07	0.58 ± 0.03	1.13 ± 0.12
Arius nenga	11	9.5	5 ± 0.05	-	-
	8	17.5	2.17 ± 0.03	1.14 ± 0.08	0.51 ± 0.06
	6	20.0	1.15 ± 0.06	2.1 ± 0.12	0.6 ± 0.08
Pentaprion longimanus.	9	7.5	2.18 ± 0.03		
Therapon jarbua.	7	6.25	2.7 ± 0.05		
	5	8.75	2.15 ± 0.03		
Scatophagus argus.	8	7.75	0.94 ± 0.02		
Lutianus johnii	3	10.5	0.97 ± 0.03		
Gobius giuris.	7	11.5	0.38 ± 0.03		
Eguula lineolata.	8	8.5	1.35 ± 0.05		
Sillago sihama.	7	10.5	0.27 ± 0.03		
	11	21.0	0.82 ± 0.03	1.77 ± 0.07	1.67 ± 0.18

Data, mean of the samples ± standard deviation.

fish collected from the estuary. Smith and Armstrong[12] expressed their concern over the same issue, as higher amounts of mercury were marked in the seals and in the blood of the local natives, to a potentially dangerous situation.

Authors are grateful to Dr. B. N. Mishra for providing Laboratory facilities. Financial assistance given to BPS by CSIR, New Delhi, is thankfully acknowledged.

1 January 1985; Revised 29 April 1985

1. Rath, P., Panigrahi, A. K. and Misra, B. N., *Curr. Sci.*, 1983, **52**, 611.
2. Hota, M., Ph.D. thesis, Berhampur University, Orissa, India, 1984.
3. Greig, R. A., Wenzloff, D. and Shelpuk, C., *Pest Monit. J.*, 1975, **9**, 15.
4. Greig, R. A., Wenzloff, D. R. and Pearce, J. B., *Marine Pollut. Bulletin*, 1976, **7**, 185.
5. Jernelov, A. and Wallin, T., *Atmos. Environ.*, 1973, **7**, 209.
6. Panigrahi, A. K. and Misra, B. N., *Environ. Pollut.*, 1978, **16**, 31.
7. Panigrahi, A. K. and Misra, B. N., *Bull. Environ. Contam. Toxicol.*, 1979, **24**, 784.
8. Satapathy, S. N., Ph.D. thesis, Berhampur University, Orissa, India, 1984.
9. Panigrahi, A. K., Ph.D. thesis, Berhampur University, Orissa, India, 1980.
10. Forrester, C. R., Ketchen, K. S. and Wong, C. C., *J. Fish. Res. Bd. Can.*, 1972, **29**, 1487.
11. Johnels, A. G., Westermark, T., Berg, W., Persson, P. I. and Sjostrand, B., *Oikos*, 1967, **18**, 323.
12. Smith, G. T. and Armstrong, F. A. J., *J. Fish. Res. Bd. Can.*, 1975, **32**, 795.
13. Anas, R. E., *Fish. Bull.*, 1974, **72**, 133.
14. Panigrahi, A. K. and Misra, B. N., *Arch. Toxicol.*, 1980, **44**, 269.

SEED COAT OF *CYAMOPSIS TETRAGONOLOBA* (L.) TAUB: STRUCTURALISM AND FUNCTIONALISM

ALKA JAIN and M. R. VIJAYARAGHAVAN
Department of Botany, University of Delhi, Delhi 110007, India

IN Leguminosae ovules, during progressive stages of seed maturation, the outer integument undergoes many changes before organizing into the seed coat. The inner integument generally disintegrates during the course of seed development. In most of the legumes, the outer epidermis of the outer integument differentiates into the macrosclereid layer[1-3] and the hypodermis into the osteosclereid layer[4-6]. The present investigation deals with the seed coat structure and function in *Cyamopsis tetragonoloba* (cluster bean, guar).

The seeds of *C. tetragonoloba*, during various stages of development, were fixed in 10% aqueous acrolein and dehydrated, infiltrated and embedded in glycol methacrylate[7]. Two micron sections were cut using glass knives and sections were stained for histochemical studies[7].

The ovule is bitegmic and crassinucellate. The outer integument is six- or seven-layered with an uniseriate epidermis. The inner integument is two- or three-layered but lyses during the seed development (figure 1). The hypodermis is the presumptive osteosclereid layer (figure 1 pos). The cells of this layer in early stages are somewhat rectangular in shape; show division in various planes, possess PAS positive granules and intercellular spaces (figure 1). In the mature seed, this layer differentiates into the osteosclereid layer only after the differentiation of the macrosclereid layer. Beneath the osteosclereid, several layers of parenchyma cells are present but these layers degenerate. All the layers of the mature seed coat lack PAS positive grains (figure 4). During progressive advancing stages of seed maturation, the outer epidermal cells of outer integument elongate only in radial direction and divide only anticlinally and on deposition of secondary wall-thickenings on their radial walls, differentiate into the macrosclereid layer (figure 2 ms). Macrosclereids in pulses are classified into three types[8]: in type I the wall thickness is usually uniform; type II reveals the end of the palisade cells away from the cuticle as bulbous; and in type III the inner wall shows well-marked corrugated regions in the lower end. The macrosclereid of cluster bean falls under type I[8].