total of the following eighteen species of recent foraminifera were recovered from the Okha beach sand: *Bathysiphon* sp indet., *Textularia foliacea* Heron-Allen and Earland, *Spiroloculina indica* Cushman and Todd, *Quinqueloculina (Miliola) kerimbatica* (Heron-Allen and Earland), *Q. seminulum* (Linné), *Triloculina terquemiana* (Brady), *T. trigonula* (Lamarck), *Bolivina striatula* Cushman, *Rectobolivina raphanus* (Parker and Jones), *Cancris auricula* (Fichtel and Moll), *Ammonia annectens* (Parker and Jones), *Pararotalia boltovskoyi* Jain and Bhatia, *Elphidium craticulatum* (Fichtel and Moll), *E. crispum* (Linné), *Poroeponides lateralis* (Terquem), *Amphistegina radiata* (Fichtel and Moll), *Cibicides lobatulus* (Walker and Jacob) and *Florilus scaphus* (Fichtel and Moll). Of these, *Quinqueloculina seminulum, Ammonia annectens, Pararotalia boltovskoyi, Elphidium craticulatum, E. crispum, Poroeponides lateralis* and *Cibicides lobatulus* are abundant; *Quinqueloculina (Miliola) kerimbatica, Rectobolivina raphanus* and *Amphistegina radiata* are frequent; and the remaining species are rare in our material. The specimens belonging to different species are of normal shape and size. The familywise break-up shows that in the Okha foraminiferal assemblage, the family miliolidae dominates and constitutes 22.2% of the total foraminiferal population. It is followed by families bolivinitidae, rotaliidae, and elphidiidae (11.1% each); and astrorhizidae, textulariidae, nubeculariidae, discorbidae, eponididae, amphisteginidae, cibicididae and nonionidae (5.55% each).

A comparison of the Okha beach foraminiferal assemblage with those reported in more recent papers from the west coast of India was also made. Jain and Bhatia[10] reported foraminifera from beach sands of Mandvi, Kutch, of which, *Spiroloculina indica, Quinqueloculina (Miliola) kerimbatica, Q. seminulum, Bolivina striatula, Rectobolivina raphanus, Cancris auricula, Pararotalia boltovskoyi, Elphidium crispum* and *Poroeponides lateralis* are common to Okha assemblage also. From Calangute beach assemblage reported by Bhalla and Nigam[11], *Quinqueloculina séminulum, Triloculina terquemiana, Cancris auricula, Ammonia annectens, Elphidium craticulatum, E. crispum, Poroeponides lateralis, Amphistegina radiata, Cibicides lobatulus* and *Florilus scaphus* also occur in our material. A comparison of the Okha beach foraminiferal assemblage with that from the Malabar coast reported by Bhalla and Raghav[12] exhibits that *Cancris auricula, Ammonia annectens, Elphidium crispum, Amphistegina radiata* and *Florilus scaphus* are common to both the beaches.

All the foraminiferal species are benthic in nature and the assemblage belongs to warm water environment.

The authors are thankful to Professor V. K. Srivastava, for facilities.

4 September 1984; Revised 15 December 1984

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CLASTOGENIC AND MITOCLASIC EFFECTS OF BENZIMIDAZOLE DERIVATIVES

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BENZIMIDAZOLES known for their varied biological actions are extensively used as fungicides and antihelminthic agents. An important feature is the presence of 5,6-dimethyl benzimidazole-α-D-ribofuranosyl group in vitamin B_{12} molecule. Pharmacological, toxicological and teratogenic properties of benzimidazoles are well understood. Studies on mutagenic activity of some fungicides belonging to the ben-

zimidazole group employing microbial and mammalian tests have been reviewed by Seiler[1]. Except for the action of benlate and carbendazim on onion chromosomes[2,3] reports on the effects of benzimidazoles on plant chromosomes are scanty. The use of plant monitors for screening genotoxicity of environmental chemicals has been strongly advocated and among them meristem assay is suggested as a preferential first-tier short-term screening method in genetic toxicology[4]. A programme was therefore initiated to screen genotoxic effects of various benzimidazoles. Clastogenic and mitoclasic effects of 2-methyl benzimidazole (MB) and 2-phenyl benzimidazole (PB) studied are reported below.

Roots from germinating bulbs of *Allium cepa* were exposed to concentrations of 10, 50 and 100 ppm of MB and PB for 2 and 24 hr at 25 ± 1°C. As the compounds were insoluble in water the above concentrations were made after initially dissolving 10 mg of the test compound in 1 ml of ethanol. Distilled water and ethanol controls have been maintained for making a strict comparison. Root tips were fixed in acetic-alcohol (1 : 3) and processed by the standard haematoxylin squash technique[5]. Roots from different bulbs belonging to treatments and controls were chosen at random for cytological analysis and a minimum number of one hundred meta- and anaphases each were scored for chromosomal and spindle disturbances.

Quantitative details on the chromosomal aber-

Table 1 *Chromosomal aberrations induced by Benzimidazole derivatives in mitotic cells of Allium cepa*

Treatment and Dose (ppm) & Duration	Metaphases with (%)			Anaphases with (%)				
	No. of metaphases scored	Fragments	Extreme fragmentation	No. of anaphases scored	Fragments	Extreme fragmentation	Bridges	Total % of aberrant cells
2 hr treatment								
Control	107	1.87	—	100	1.00	—	—	1.45
Ethanol control								
10	100	2.00	—	113	5.31	—	—	3.76
50	102	2.00	—	126	4.76	—	—	3.51
100	123	0.81	—	105	3.81	—	—	2.19
Methylbenzimidazole (MB)								
10	124	2.42	—	100	3.00	—	—	2.68
50	100	3.00	1.00	100	6.00	—	—	5.00*
100	147	4.76	0.68	101	6.93	—	—	6.05†
Phenylbenzimidazole (PB)								
10	108	0.93	—	110	0.91	—	0.91	1.38
50	100	1.00	—	114	2.63	—	1.75	2.80
100	111	—	—	102	0.98	—	5.88	3.29
24 hr treatment								
Control	104	3.85	—	162	1.23	—	0.62	2.63
Ethanol control								
10	102	0.98	—	168	7.74	—	—	5.19*
50	108	7.41	—	102	8.82	—	—	8.10*
100	100	11.00	—	108	7.41	—	—	9.13*
Methylbenzimidazole (MB)								
10	104	12.50	0.96	117	9.40	—	—	11.31†
50	101	9.90	1.98	104	13.46	2.89	—	14.15†
100	102	12.75	1.96	126	9.52	—	0.79	12.28*
Phenylbenzimidazole (PB)								
10	124	16.94	2.42	134	9.70	0.75	—	14.73†
50	100	20.00	9.00	114	38.60	4.39	—	36.45†
100	117	34.18	8.55	102	32.35	11.77	0.98	43.84†

* Significant at 5% level as compared to distilled water control.
† Significant at 5% level as compared to distilled water & ethanol control.

rations induced by MB and PB following 2 and 24 hr treatment are provided in table 1. Control values are also furnished in each case. Chromosomal fragments at meta- and anaphases and bridges at anaphase were recorded. Some of the meta- and anaphases showed extreme fragmentation. Total percentage of aberrant cells seen after 2 hr treatment in ethanol control is statistically not significant as compared to distilled water controls. This is also true for PB treatments at all concentrations. In MB treatments a high rate of aberrant cells is noted at 50 and 100 ppm levels and they are statistically significant as compared to distilled water control. Chromosome aberrations induced following 24 hr treatment with ethanol, MB and PB are significantly higher compared to distilled water control. Aberrations in MB and PB treatments are higher than in ethanol controls and also show a statistical significance except for 100 ppm of MB. Phenylbenzimidazole is more potent in inducing chromosome damage than methyl benzimidazole following 24 hr exposure and it also reveals a dose-dependent response. Comparison between 2 and 24 hr treatments shows that the latter induce a higher rate of aberrations and indicate that delayed effects are more pronounced than non delayed effects[6]. These observations reveal a strong clastogenic action of benzimidazole derivatives in *Allium* test.

Varying degrees of chromosome contraction were noted in all concentrations in both treatments of benzimidazole and were found to be higher in MB series. Occurrence of these C-metaphases, due to dysfunction of the spindle, suggests mitoclasic property of methyl and phenyl benzimidazole. The colchicine-like effects suggest a possible use of benzimidazole as pre-treating agent for chromosome analysis[7].

Clastogenic and mitoclasic effects of MB and PB reported here are not very surprising since benzimidazoles are known to induce mutations in bacteria by base substitution or may interfere with the mitotic function by acting as a spindle poison as seen in *Aspergillus nidulans*[1]. Some of the fungicides which may not bear any resemblance to benzimidazoles may be metabolically converted by plants and animals to simple benzimidazoles by clevage of the side chain[8]. Hence the above findings with methyl and phenyl benzimidazole indicate that caution should be exercised in using benzimidazoles as fungicides or anti-helminthic agents. A detailed study on the stage specific effects and quantification of mitoclasic effects is necessary and work on these lines is in progress.

The authors thank Profs. G. M. Reddy, M. S. Rao, C. V. Ratnam and S. Subramanyam for their interest and encouragement.

9 October 1984

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RICE CHAFF AND RACHILLAE—POTENTIAL INOCULUM SOURCES FOR SHEATH BLIGHT INFECTION

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RICE sheath blight (*Rhizoctonia solani* Kuhn (*Thanatephorus cucumeris* (Frank) Donk.) is hampering rice production in several rice growing states of India. It is reported that the causal fungus perpetuates from season to season as sclerotia or mycelia in soil[1, 2], infected rice straw[3], seed[4, 5] and on many weeds[6]. The role of chaff and rachillae of the infected panicles has not been investigated in the perpetuation and transmission of the pathogen, although sheath blight infection is known to increase empty grains[7, 8]. The present investigation was, therefore, carried out to elucidate the role of rachillae and chaff in the perpetuation of infection from season to season.

During the wet season of 1983 (June–October), plants of AC 360, a highly susceptible cultivar to sheath blight were grown in 1.2 m × 1.2 m size plots under a high fertility level of N_{120} P_{60} K_{60} kg/ha. When the plants were 75 days old, they were inoculated following the method described earlier[9] and the disease was