2. Knoll, F., *Abh. Zool-bot. Ges Wien*, 1926, **12**, 379.
3. Vander Pijl, L., *Ann. Bogor.*, 1953, **1**, 77.
4. Meeuse, B. J. D., *The Biologist*, 1959, **42**, 22.
5. Meeuse, B. J. D. and Hatch, M. H., *The Coleopterists Bull.*, 1960, **14**, 70.
6. Faegri, K. and Vander Pijl, L., *The principles of pollination ecology*, Pergamon Press (Oxford). 1966.
7. Proctor, M. and Yeo, P. F., *The pollination of flowers*, Collins, London, 1973.

UNRECORDED PATHOGEN ON WHEAT IN INDIA

S. KULKARNI, S. N. CHATTANNAVAR, V. B. NARGUND and R. K. HEGDE
Department of Plant Pathology, College of Agriculture, Dharwad 580005, India.

WHEAT crop is susceptible to several diseases *viz* stem rust, leaf rust, yellow rust, leaf blight, karnal bunt, hill bunt etc. In the present study, an epidemic of leaf blotch disease on wheat observed during 1980–81 at the College of Agriculture, Dharwad is reported. The first symptom of the disease was noticed on the leaves. As the plant enters the reproductive stage, the blighting spread to top leaves. Flag leaf and glumes also were affected. The spots on leaf were brown in colour with a clear yellow halo indicating that the organism produces toxin injurious to the plant tissue (figure 1). The blotching was common on leaves and glumes. Under favourable conditions, the plant exhibited a burnt appearance. The pathogen was isolated successfully and pathogenicity was proved. Typical symptoms of the disease appeared on the leaves after ten days of inoculation.

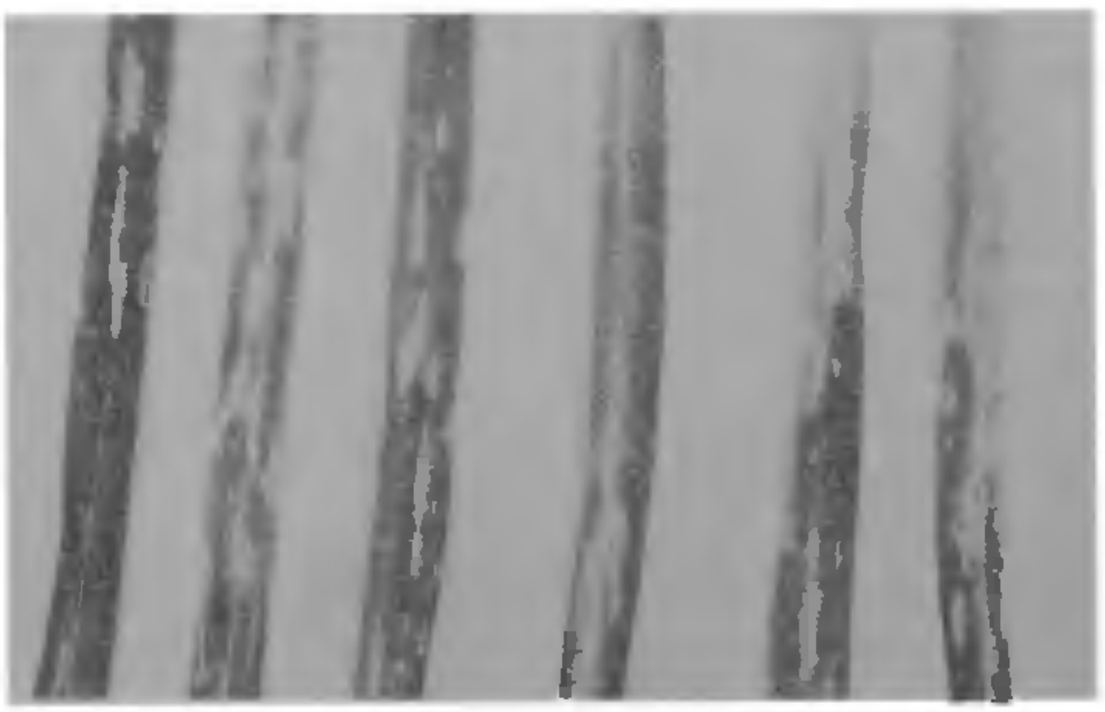

Figure 1. Symptom of *D. hawaiiensis* on wheat.

The colonies of the fungus were effuse, grey pale to dark brown in colour smooth, septate. Conidiophores solitary, geniculate, septate measuring upto 120 μ long and 2–7 μ in thickness. Conidia straight, ellipsoidal, oblong or cylindrical, rounded at the ends with 3–8 pseudo septate, measuring 13–37 μ.

This fungus was identified by Dr A. Sivanesan of the Commonwealth Mycological Institute, Kew, Surrey, London, as *Drechslera hawaiiensis* M. B. Ellis state *Cochliobolus hawaiiensis* Alcorn with Herb. IMI. number 274351.

This is a new pathogen on wheat hitherto unrecorded in India.

3 October 1984; Revised 10 April 1985

KARYOLOGICAL STUDIES IN THE GENUS *CYMBOPOGON* SPRENG II. KARYOTYPE OF *CYMBOPOGON WINTERIANUS* JOWITT.

V. VERMA
Regional Research Laboratory, Canal Road, Jammu-Tawi 180001, India.

CYMBOPOGON WINTERIANUS Jowitt (Fam. Gramineae) is an important aromatic and medicinal plant. It is also famous as Java citronella grass for its high quality aromatic oil containing a high percentage of geraniol and citronella—pharmaceutically the two very important monoterpenes[1–6]. The grass is native to Sri Lanka, where it is locally known as Mahapongiri[7] and is similar to Ceylon citronella (*C. nardus*) in many respects[8]. Although a lot of data are available on its cultivation, agronomy, commerce[7–9] and chemical analysis of its essential oil[1–6,10] its karyotype has not been reported so far except for recording its chromosome number, $2n = 20$[11].

Plants were collected from the hilly areas of Assam and raised in the experimental garden of the laboratory. Some slips were allowed to root at room temperature. Root tips were processed for the karyotypic analysis on the basis of modified techniques reported earlier[12]. For description of karyotype the method of Adhikary[13] has been adopted.

Twenty chromosomes were counted from the somatic cells (figure 1). The chromosomes are small, the chromosome length ranging from 1.4 to 2.5 μ, and the total haploid chromatin length is 9.47 μ (table 1). The karyotype formula is $2n = 20 = 20\,\text{nM} = 10\text{B} + 10\text{F}$ (karyotype formula is based upon the chromosome classification adopted for the other *Cymbopogon* species investigated earlier[12]). The idiogram of the chromosomes is shown in figure 2.

The karyotype of *C. winterianus* shows a general resemblance to the karyotypes of other 5 diploid species, reported earlier[12] and to *C. flexuosus* (Cytotype I, geraniol chemotype) in particular in having no secondarily constricted chromosomes, chromosomes belonging to only long and medium types (*i.e.* X and Y) and in having all the chromosomes

Figure 1. Karyotype of *C. winterianus*.

Table 1 *Karyomorphological data including total length (TL)*

	Long			Medium		
	M	nM	nSM	M	nM	nSM
Cymbopogon winterianus						
$2n = 20$,						
$n = 10$	–	5	–	–	5	–
TL	–	2.0–2.5 (= 2.22)	–	–	1.4–1.95 (= 1.71)	–
RL	–	5.13–6.41 (= 5.70)	–	–	3.59–5.0 (= 4.40)	–
AR	–	0.67–0.92 (= 0.82)	–	–	0.87–0.95 (= 0.83)	–

Total chromatin = 9.47 μ; Karyotype formula = 5B + 5F*

* Based on chromosome classification[12]. Relative Length (RL), ARM ratio (AR = Short ARM/Long ARM) and total chromatin length values for *Cymbopogon Winterianus* (values in paranthesis are the mean values).

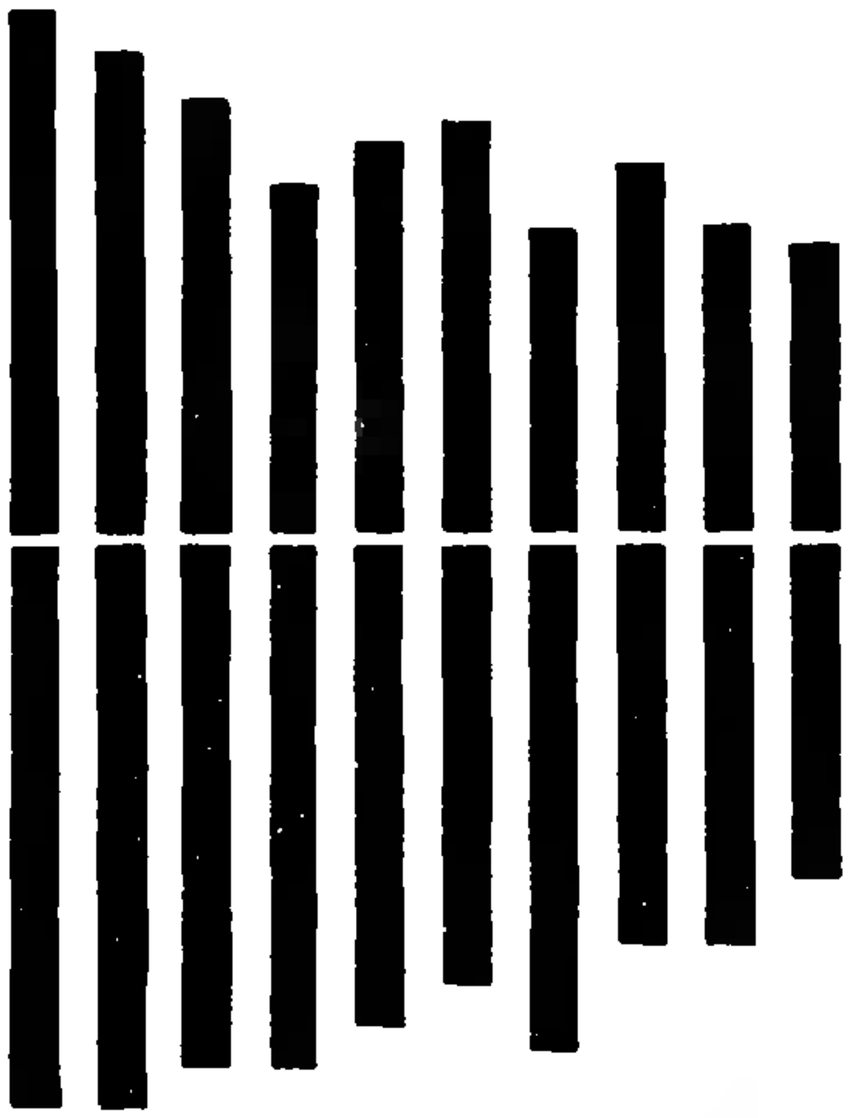

Figure 2. Karyogram of *C. winterianus*.

with nearly median (nM) centromeres. Another diploid species *C. martinii* var. *motia* ($2n = 20$) also has all nearly median (nM) chromosomes[12]. The frequency of nearly median (nM) chromosomes is generally high in other *Cymbopogon* species investigated as well[12] with only other types being nearly submedian (nSM) followed by median (M). Other types of centromeres have not been reported in the genus *Cymbopogon* so far.

The presence of comparatively symmetrical karyotype in this species like those of *C. flexuosus* (cytotype I, geraniol chemotype), *C. jwarancusa*. *C. martinii* var. *motia*, *C. martinii* var. *sofia* and *C. flexuosus* (cytotype II)[12] suggests that the species is closely related to the ancestral stock. The karyotypes of comparatively modern species, having varying degrees of asymmetry, might have originated from the above ancestral forms by structural changes in the chromosomes and their repatterning including increase and decrease in their sizes as proposed by some workers[14, 16].

It is clear from the above data that this species is closely related to *C. flexuosus* (cytotype I, geraniol chemotype) which it resembles to some extent morphologically also (to be reported elsewhere). It is probable that the two species might have originated from a common ancestor but diverged later due to geographical and ecological separation.

Meiotic analysis of this species could not be done as it does not flower under local conditions although it flowers in Jorhat (Assam) in winter, from where the

plants were collected. Work is in progress to induce flowering in the species by various physiological and chemical methods.

24 October 1984; Revised 11 February 1985

1. Baslas, R. K. and Baslas, K. K., *Perfum. Essent. Oil. Rec.*, 1969, **60**, 341.
2. Guenther, E., *Soap. Sonit. Chem.*, 1942a, **18**, 24, 68 and *Bull. Imp. Inst. London*, **40**, 127.
3. Guenther, E., *Soap. Sonit. Chem.*, 1942b, 18, 27, *Chem. Abstr.*, 1943, **37**, 3878.
4. Guenther, E., *The essential oils IV*, D. Van. Nostrand Co. Inc., London, 1950, p.67.
5. Sood, V. K., *Indian For.*, 1974, **100**, 562.
6. Virmani, O. P. and Datta, S. C., *The Flavour Industry*, 1971, **21**, 595 & 710.
7. Dimri, B. P., Naryana, M. R. and Khan, M. N. A., *Proc. All India Co-ordinated Improvement Project of Medicinal and Aromatic Plants*, Ist Workshop, *Univ. Agric. Sci.*, Bangalore, 1973, p. 172.
8. Jagdishcnandra, K. S., *J. Plant. Crops*, 1975b, **3**, 1.
9. Singh, R. S., Baruah, A. K. S., Singh, K. K. and Ganguly, D., *Ind. Perf.*, 1976, **20**, 115.
10. Thappa, R. N., Bradu, B. L., Vashist V. N. and Atal, C. K., *The Flavour Industry*, 1971, **20**, 49.
11. Jagdishchandra, K. S., *J. Plant. Crops*, 1975c, **3**, 43.
12. Verma, V. and Sobti, S. N., *The nucleus*, 1982, **25**, 165.
13. Adhikary, A. K., *Cytologia*, 1974, **39**, 11.
14. Ehrendorfer, F., Krendl, F., Habeler, E. and Sauer, W., *Taxon*, 1968, **17**, 337.
15. Stebbins, G. L., *Variation and evolution in plants*. Oxford, IBH Calcutta, 1950, p. 643.
16. Stebbins, G. L., The evolution of karyotype: In *Chromosome evolution of higher plants*. Edward Arnold Ltd, London, 1971, p. 85.

BIOCHEMICAL CHANGES IN WHITE RUST INFECTED LEAVES OF *BOERHAAVIA DIFFUSA* L

K. ARVIND KUMAR and
C. MANOHARACHARY
Department of Botany, Osmania University, Hyderabad 500 007, India.

BOERHAAVIA DIFFUSA L is a commonly available medicinal plant in and around Hyderabad. This plant has been found heavily infected by *Albugo* during August to October, 1984. The biochemical changes of white rust infected leaves of *B. diffusa* have not been worked out earlier. Hence, data collected have been presented in this paper.

The pathogen has been identified as *Albugo platensis* (Speg) Swingle[1]. The healthy and diseased leaves of *B. diffusa* were analysed for chlorophyll, total phenols, catalase, peroxidase, polyphenoloxidase, reducing sugars and starch following standard techniques[2].

Table 1 reveals the biochemical changes in some biochemical factors as observed in diseased and healthy leaves. It is evident that the total chlorophyll content, reducing sugars, and starch contents have been reduced as compared to healthy leaves. Phenol accumulation has been observed in the infected leaves. Peroxidase and polyphenoloxidase enzymes enhanced their activity in infected leaves. In the present study catalase limited activity was found in the infected leaves. Similar results were obtained earlier[2-7].

In conclusion the present data show that the natural organic composition of the host is affected as a result of infection by the pathogen.

KAK thanks CSIR authorities for the award of a fellowship.

26 December 1984; Revised 12 April 1985

1. Butler, E. J. and Bisby, G. R., The fungi of India, *Imp. Coun. Agric. Res. India Sci. Monogr.*, 1931, I, **28**, 237.

Table 1. *Biochemical changes in infected leaves.*

mgs of Chl					Absorbancy (420 nm)			
	a	b	a/b ratio	Total phenols	Catalase activity (mM)	Peroxidase	Polyphenol-oxidase	Reducing sugars wt.	Starch wt.
Healthy	1.74	0.67	2.6	480	0.15	0.05	0.36	10270	11250
Infected	0 88	0.51	1.75	600	0 10	0.60	0.55	1501	1351

Chl is expressed as g/fr. wt; total phenols, reducing sugars and starch in μg/g fr. wt. Catalase activity is expressed as mMH_2O_2 used/min/9. fr. wt.