https://doi.org/10.29321/MAJ.10.A02574

Madras Agric. J 70 (1) : 39—44 January 1983

Succession of Microbial Communities in Jute and Mesta Rets

G. SUBRAMANIA IYER[1] and P RAJASEKARAN[2]

Experiments carried out to study the succession of microbial communities in the retting of jute and mesta with varying quantities of water revealed variations in their distributions. The bacterial population showed an increasing trend with the progress of retting until completion. Wider variations were observed in the distribution of yeast, fungal and pectolytic bacteria. The anaerobic bacteria was found maximum during the 10th day. The acid forming bacteria differed with PH and varying levels of acids produced during the retting process. A combination of different groups of efficient organisms might be helpful in quickening the process of retting.

That the process of retting, mediated by microorgaisms is well documented. (Chesson, 1978) Utilisation of various organisms as tools is by far the most important and cheapest method among the differant processes employed viz. Mechanical, Chemical and others in the retting of commercial crops like jute and mesta. The various flora in the rets follow different patterns of distribution during the process of retting. Experiments were conducted in this laboratory not only to study the pattern of succession of microbial communities but also to learn whether they could help in quickening the retting process.

METERIAL AND METHODS:

Jute and mesta plants obtained from the cotton breeding station were tied into bundles of 2 kg. each after removing the leaves and cutting off the branches and were immersed in water In the ratios 1:15 and 1:20 (Plant : Water) for jute and 1:10 and 1:15 for mesta in 1X0.5 X0.5 m. concrete tanks. Water (Ret liquor) samples were collected as per standard methods on the 5th, 10th 15th and 20th days and screened for the microbial population following approved procedures.

Total bacteria was enumerated in Nutrient glucose agar (Allen, 1953). Total yeast was enumerated in medium containing yeast extract 10 g; Peptone 20 g; Glucose 20 g; Agar 15 g in one litre distilled water. The total fungi was enumerated in Martins Rose Bengal agar containing Dextrose 1.00g; Peptone 5.0 g; $KH_2 Po_4$ - 1.00g; $Mg So_4$ 0 5g; Rose Bengal (1 in 30000) Agar 20.0g; streptomycin sulphate (30.0 mg) in one litre distilled water.

The cellulolytic bacteria were enumerated in Dubos cellulolytic medium having $NaNo_3$-1.0g; $Mg So_4$-0.5g; K_2HPO_4 0.5g; Kcl 0.5g; $Fe_2(SO_4)_3$-Trace; Agar 15.0g in one litre distilled water with a 10 mm. filter paper disc as the carbon source. The pectolytic bacteria were enumerated in modified Dubo's medium with sodium polypec-

1 M Sc(Ag) Student and 2 Associate Professor Dept of Agricultural Microbiology Tamil Nadu Agricultural University Coimbatore-641 003.

late as the carbon source. The anaerobic bacteria were enumerated adopting MPN method (Siebert and Hattingh, 1967) in medium of the following composition Yeast extract 5.0g; casein hydrolysate 15.0g; Glucose 5.5g; L-cystine 0.5g; Nacl 2.5g; Sodium thioglycollate 0.5g; 'Agar 0 75g; Resazurin (1 in 1000 Solution) 1 ml. in one litre distilled water.

The pH of the ret liquors was measured once in two days and the acid forming bacteria enumerated as described by Chynoweth and Mah, 1977).

RESULTS AND DISCUSSION

The bacterial population showed an increasing trend with the progress in retting, upto the completion (Table1) Also an increase in population was observed with increase in dilution in jute, while in the case of mesta, upto the 5th day, maximum population was observed in the 1:15 ratio; but afterwards it was in 1:10 ratio. The highest population recorded was (66.66 $\times$ 10^6 per ml) in the case of 1.20 of jute on the 20th day while in mesta it was in 1:10 (152.66 X 10^6 per ml.) ratio. Similar results obtained by Roy and Mandal (1967) lend support to the above finding. The increase in population with the increase in plants : water ratio observed in jute might have been due to the dilution of toxic metabolites like polyphenols and also due to the occurence of catabolite repression in lower dilutions (Chesson 1978). In the case of mesta, the higher population in the 1:10 ratio might be due to the congenial conditions, as the content of degradable material in the plant is less when compared to jute (Maiti, 1969).

The yeast population also showed similar trends of bacteria. Jute (1:20) maintained a higher population through out (92.00 $\times$ 10^4 per ml) while in the case of mesta, the higher was observed in the 1:15 ratio upto the 10th day while the 1:10 ratio showed higher counts thereafter. The higher population observed in the 1:20 ratio of jute might be due to the greater release of breakdown products like sugars by the higher bacterial population. Similar trends were observed by Bhat *et al* (1972) in coir rets. In the case of mesta the higher bacterial population observed in the 1:15 ratio upto the 5th day might have released more breakdown products compared to the 1;10 ratio. enbancing the yeast population. But the higher bacterial population on the 10th, 15th and 20th days in the 1:10 ratio might have enabled the faster growth and higher population of yeasts thereafter.

A steady increase in fungal population was observed after an initial drop (Table 1) The initial drop might have been due to the polyphenols released, and the lack of nutrients due to the competition. A slight decrease in PH also observed upto 5th day (vide Table3) This coincided with the initial drop in fungal population which needs further clarity as fungi are known to thrive well in lower pH. The occureance of fungal population in larger numbers

in an anaerobic environment is unlikely However, relative distribution of fungi revealed variations in the treatments of both jute and mesta. The treatments in mesta in general maintained higher fungal population. This might be due to preferential stimulation of fungi associated with specific fibre crops and also the nutrients, PH etc. factors associated with it.

The highest fungal population in jute (34.33 × 10^3 per ml) was observed in 1:20 ratio while in mesta (38.66 × 10^3 per ml.) it was In 1;10 both being on the 20th day. The higher population in the 1:20 ratio of jute might be due to the dilution of toxic metabolites and in the case of 1:10 ratio of mesta, greater nutrient availability and the higher initial load might have resulted in higher fungal population. The maximum populations observed on the 20th day might be due to the presence of cellulose which is easily degraded by many fungi.

The ability of bacteria to degrade cellulosic fibres is well known (Bhattacharyya; 1973). An increasing trend in the cellulolytic population was observed with the highest counts being recorded on the 20th day (vide Table 2) The maximum population was observed in the 1:20 ratio of jute (52.66 × 10^4 per ml) and the 1:15 ratio of mesta (59.33 × 10^4 per ml.) Higher number, of cellulolytic bacteria have been defected towards the end of flax retting (Chesson, 1980).

The role played by pectolytic bacteria in retting is well documented (Baruah and Baruab, 1946); Jayasankar *et al*, 1967 Roy and Mandal, 1967, B at and Nambudiri, 1971; Chesson, 1978 and 1980). In the present study the pectolytic bacterial population (Table 2) increased reaching the maximum (66.66 × 10^4 per ml. and 71.33 × 10^4 per ml for 1:20 of jute and 1:15 of mesta respectively) during the 10th day followed by a reduction reaching the minimum on the 20th day Similar results were obtained by Chesson (1980). A slight disturbance in the regime of rettingcauses a decrease in the pectolytic flora (Andrejuk *et al*, 1978). The concentration of galacturonic acid in the maceration water was found to increase in the first phase of retting followed by a decrease in the last phase (Defranca *et al*; 1970). This indicates the population trend of pectolytic flora and lend support to the above findings.

That anaerobic bacteria, (Table 2) play a key role in the process of retting is well known (Andrejuk *et al*, 1978). In the present study the anaerobic bacteria followed the same trend as that of pectolytic flora reaching the maximum population on the 10th day (160.9 × 10^3 per ml for jute in 1:15 and 91.8 × 10^3 per ml for mesta in 1;15 treatments) followed by a decline. Similar trends were observed by Roy and Mandal (1967). The similarity in the trend in pectolytic and anaerobic bacterial population indicates the capacity of anaerobic bacteria to utilize pectinor its break down products (Chesson, 1978).

Wider variations were observed in the population of acid forming bacteria (Table 3) The maximum populations (79.0 x 10^3 per ml, 105.0 x 10^3/ml and 62.0X10^3 perml) were observed in 1:15 ratio of jute and 1:10 and 1:15 ratios of mesta respectively on the 10th day while in 1:20 the maximum population (69.66 x 10^3 per ml.) was also found out every alternate days (Table 3). A negative insignificant correlation was observed between the pH and acid forming organisms. This might have been due to the feed back in inhibition of acid formers. Also the higher acid concentrations might have affected the other organisms like pectolytic bacteria (Myser Ali *et al.* 1970) which in turn might have restricted the release of degraded substances affecting the aid forming population.

The various organic acids elaborated as the break down end products by acid forming organisms forms the basic substrates for utilization by many anaerobic bacteria. Probably the organic acids so formed might have helped in the specific proliferation of a selected group of anaerobic organisms capable of effecting efficient brakdown of pectic substances.

REFERENCES

ALLEN, O N1953 *Experiments in soil Microbiology* Burgess Publishing co., Minneapalis.Minn p 127

ANDREJUK, E. I., N. N. MALTSEVA, S. A GORDIENKO V. T. TATARENKOV and E.V. KALYUGINA 1978 Microbiological process during different technological regimes of flax, retting Communcation I Microbiological princil ples of industrial flax retting. : *Miktobiol zh., 40.* 315-321

BARUAH, P and H.K. BARUAH. 1946 Retting by Hiparol and by bacteria *Sci. Cult., 11.* 369-373

BHAT, J V. and A.M D. NAMBUDIRI 1971 The Uniquity of Coir retting *J Sci Ind Res., 30* 17-28.

BHAT, J.V., A. M. D. NAMBUDIRI and B.V RAO 1972 Pattern of bacterial and yeast populations of coir rets. *Coir., 17* : 13-15

BHATTACHARYYA, S K. 1973. Retting of Jute-A key process that needs more attention. *Jute. Bulletin;, 36* 194-198

CHESSON, A. 1978. The maceration of linen flax under anaerobic conditions. *J Appl. Bacteriol 45* . 219-230

CHESSON, A. 1980. Maceration in relation to the post harvest handling and processing of plant material a review. *J Appl Bacteriol* 48. 1- 45

CHYNOWETH. O.P and R.A. MAH. 1977. Bacterial populations and end products during anaerobic sludge fermentation of glucose *J water, poll, Control, Fed. 1:* 405 406

DEFRANCA, F.P., A.M. DE JESUS and J A ROSEMBERG. 1970 Phases of retting flax. *Rev. Latinoameric. Microbiol,. 13* : 199 - 202, (*Chem. Abst., 76* 1972/142183)

JAYASANKAR, N.P., A.D. AGATE and J V BHAT. 1967 Microbial decomposition of Pectic Substances. V Evidence for the role of *Micrococcus* sp in the retting of sisal and coconut husks. *J. Indian. Inst. Sci., 49* : 10-18

MAITI, R.K 1969. *Hibiscus vitifolius*, a new fibre crop. *Econ. Bot., 23.* 141-147

MYSER, ALI, M., A.Z.M. SAYEM and M. ESCHEQUE: 1970. Effect of retting liquor neutralization on the progress of retting and fibre quality,. *Sci. Ind.,* (Pakistan) -7 : 134-136

ROY, A.B. and A. K. MANDAL, 1967. Retting and quality of jute fibre *Jute Bulletin, 30* 131-140

SIEBERT. M.L. and W. H.J. HATTINGH. 1967 Estimation of methane producing bacterial numbers by the most probable number. *Water Res., 1:* 13.

TABLE: 1 Distribution of Microbial Population During Different Stages In Jute And Mesta Rets*

Microflora	No. of days of retting	Treatments (Plant : water ratio)			
		Jute		Mesta	
		1:15	1:20	1:10	1:15
Bacteria ($X10^6$ per ml.)	First	16.50	13.96	23.00	17.35
	5th	56.66	67.00	47.66	57.66
	10th	74.33	116.66	115.66	93 33
	15th	65.00	107.33	104.33	82.33
	20th	110.00	166.66	152 66	116.66
Yeast ($X10^4$ per ml.)	First	20.33	15.00	22.33	18.66
	5th	36.66	44.33	39.66	42 66
	10th	40.33	55.66	46.00	50.66
	15th	53.66	73.33	70.33	52.33
	20th	62.66	92.00	82.66	54.33
Fungi ($X10^3$ per ml.)	First	17.00	15.66	21.33	18 33
	5th	9.66	16.00	11.33	9.66
	10th	10.33	14.66	13.00	12.00
	15th	15.66	23.33	20.66	18.33
	20th	22.00	34.33	38.66	22.66

* Figures represent mean of three replications

TABLE; 2 Distribution of Different Bacteriae During Different Periods of retting of Jute And Mesta

Treatments (Plant: Water)	No of days of retting		
	First day	10th day	20th day
	a) Cellulelytic bactoria (X 10^4 per ml)*		
Jute 1:15	6.33	21.6	48.3
Jute 1 . 20	4.00	23.6	52.6
Mesta 1 : 10	9.66	19.3	45.6
Mesta 1 ; 15	6.66	25.3	59 3
	b) Pectolytic bacteria (X10^4 per ml)*		
Jute 1 ; 15	12.33	62.3	30.6
Jute 1 : 20	9.66	66.6	28.0
Mesta 1 ; 10	14.33	69.0	29 6
Mesta 1 : 15	12.66	71.3	38 6
	c) Anaerobic bacteria (X 10^3 per ml.)**		
Jute 1 ; 15	7.0	1609	172
Jute 1 ; 20	5.0	918	348
Mesta 1 ; 10	9.0	141	70
Mesta 1 : 15	7,0	918	221
	d) Acid forming bacteria (X 10^3/per ml.)*		
Jute 1 ; 15	17.66	79.0	66 3
Jute 1 ; 20	14.00	61.66	60.0
Mesta 1 : 10	20.33	105.00	63.6
Mesta 1 ; 15	15.33	62.00	54 3

* Mean of three replications.

TABLE 3 Variation In The PH of The Ret Liquors During The Retting of Jute And Mesta

Period of retting (Days)	PH of ret liquor			
	Treatment (Plant ; Water)			
	Jute		Mesta	
	1:15	1:20	1:10	1:15
Initial	7.25	7.25	7.25	7.25
2nd	6.45	6.50	6.10	6.50
4th	6.05	6.16	5.90	6.20
6th	6.70	6.80	6.60	6.40
8th	7.00	6.65	6.75	6.90
10th	6.50	6.90	6.20	6.80
12th	6.80	6.40	6.60	6.90
14th	7.00	6.50	6.90	6.70
16th	6.80	7.00	7.20	7.10
18th	6.90	6.80	7.10	7.20
20th	7.10	6.90	7.20	7.10