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Study on Physio-morphological Characteristics of Different Local Pummelo Accessions

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Abstract: Physio-morphological characteristics of 30 local accessions of pummelo were studied at the existing plantation of the Regional Agricultural Research Station (RARS), Ishurdi, Pabna during the period from October 2000 to October 2001. Among the 30 local pummelo accessions, accession number 6, 8, 10, 15, 17 and 22 were found better in respect of fruit characteristics compared to the rest of the accessions. The plants of accession number 8 bore the maximum number of fruits (52.66) and plants of accession number 5 bore the minimum number of fruits (13.00). The fruit of accession number 27 was the heaviest (2160 g) whereas accession number 7 produced the smallest fruits (718.33 g). Fruits of accession number 6 contained the highest TSS (9.66%). The edible qualities of accession number 6, 8, 15, 17, 21 and 22 were found better compared to others. All most all the characteristics viz. fruits plant⁻¹, fruit weight, fruit diameter, rind thickness, number of segments fruit⁻¹. TSS percentage with eating quality of fruit were preferable in accession number 22.

Key words: Physio-morphology, pummelo, accession

Introduction

Pummelo (*Citrus grandis*, Osbeck) has been regarded as one of the ancestral species as well as important commercial fruit crop under the genus Citrus (Verdi, 1988). In Bangladesh pummelo is known as "Zambura", "Batabi Lebu and "Badam". Pummelo can help overcoming the malnutritional problem which is very much wide spread (about 931%) in Bangladesh. Bangladesh stands in a very low position in respect of the production as well as yield of pummelo fruits in comparison to other pummelo producing countries of the world like China, Thailand, Vietnam, Malaysia, etc. particularly due to lack of high yielding and good quality variety. Recently, Bangladesh Agricultural Research Institute (BARI) has released two recommended variety of pummelo in Bangladesh. For improving the production as well as yield of pummelo fruits in Bangladesh. Regional Agricultural Research Station (RARS), Ishurdi, Pabna has already collected some local pummelo accessions from different districts of Bangladesh. There is a need to intensify research efforts in several areas, particularly the selection of superior genotypes. Therefore, the present study was undertaken to observe the performance of 30 local accessions of pummelo.

Materials and Methods

This study was undertaken at the existing plantation of the Regional Agricultural Research Station (RARS), Ishurdi, Pabna, during the period from October 2000 to October 2001. The treatment consisted of 30 local

accessions of pummelo plants. The experiment was laid out in the Randomized Complete Block Design (RCBD) with three replications. One accession represented one treatment and one plant in an accession represented one replication. The experimental soil was sandy loam in texture. Land type was calcareous, medium high land with internal as well as external drainage facilities. The saplings were planted on 17 September 1987 at the Regional Agricultural Research Station (RARS), Ishurdi, Pabna. The plants were about thirteen (13) years old during the period of study. Intercultural operation was done as an when needed including weeding and irrigation. Fruits of accession numbers 1 to 15 were harvested on 10 October 2001 and that of rest were harvested on 11 October 2001. Data were recorded for the plant height, spread at north-south and east-west, base girth, number of primary branches plant⁻¹, plant growth, tree volume, leaf lamina area, wing area, ratio of lamina and wing, leaf length, leaf width, fruits plant⁻¹, fruit weight, fruit diameter, fruit weight without rind, rind thickness, number of segments fruit⁻¹, length of segments, pulp weight, total soluble solid (TSS) percentage, number of seeds fruit⁻¹ and mean weight of one seed and statistically analyzed. Plant growth was determined by a formula Height x North-south spread x East-west spread x 0.7 a constant factor for citrus fruits (Hossain, 1985). Tree volume was calculated by using the formula of Castle (1983). Sweetness, bitterness, juiciness and softness of the pulp were recorded through organoleptic taste by a panel of ten judges. The significance of the difference between treatments means

was evaluated by least significance difference (LSD) test for the interpretation of the results (Gomez and Gomez, 1984).

Results and Discussion

Morphological characteristics: The results of this study are presented in Table 1. The plant height as observed in this experiment varied from 189.33 cm to 457.33 cm with the mean value of 356.41 cm. The tallest plant (457.33 cm) was found in accession number 4 followed by accession number 8 (456.33 cm) while the shortest (189.33 cm) was recorded in accession number 14. The results obtained corroborated with the findings of Hossain (1985). The base girth varied from 35.66 cm (accession number 25) to 76.66 cm (accession number 8) with the mean value of 56.05 cm. Accession number 29 produced highest number of primary branches (44.33) while accession number 9, 28 had the least number of primary branches (6.33, 7.66, respectively) plant⁻¹. The plants of accession number 11 8 showed the most vigorous growth (61.04 m³) while the minimum growth was observed in accession number 11 (8.09 m³). The highest tree volume (14.60 m³) was found in accession number 8 while the lowest (2.02 m³) was recorded in accession number 11. The largest lamina area (41.95 cm²) was found in accession number I I and the smallest in 30 (17.70 cm²) Accession number 5 produced largest wing area (5.37 cm²) whereas accession number 17 had the smallest wing area (0.18 cm²). The longest leaf length (11.83) in accession number 3 while the shortest length (9.54 cm) was observed in accession number 30 with the mean value of 11.70 cm. The plants of accession number 7 showed the highest leaf width (7.31 cm) while the lowest width (4.31 cm) was observed in accession number 29.

Fruit characteristics: Fruit characteristics of 30 local pummelo accessions are presented in Table 2. A wide variation was observed in case of fruits plant⁻¹. (13.00 to 52.66). The plants of accession number 5 bears the minimum number of fruits (13.00) whereas accession number 8 bears the maximum number of fruits (52.66) followed by accession number 22 (45.00). This large variation in number of fruits plant⁻¹ might be due to different genetical characteristics and physiological development of the plant. Fruit weight of different accessions widely varied from 718 g to 2160 g. This finding was almost in agreement with that reported by Cedeno-Maldonado *et al.* (1993) in pummelo (700-1000 g). Accession number 27 produced the heaviest (2160 g) fruits with an average weight of 1123.28 g while the lightest fruits (718 g) was observed in accession number 7. This variation could be genetical, physiological,

nutritional or environmental influences. Fruit diameter varied widely from 9.54 cm in accession number 24 to 18.94 cm in accession 27. The heaviest fruit weight without rind (1419 g) was recorded from accession number 27 followed by accession number 9, 28 (1076, 1065 g, respectively) while the lightest (378 g) was recorded in accession number 11. This result supports the findings of Hayes (1966) and Hossain (1983). Rind of the fruits of accession number 18 was the thickest (2.53 cm) followed by accession number 16, 6 (2.33, 2.02 cm, respectively) whereas the thinnest rind was observed in accession number 25 having 0.70 cm with the average value of 1.37 cm. This is in agreement with the findings of Hossain (1983). The number of segments fruits⁻¹ ranged from 9.66 (accession number 5, 11 and 20) to 14.66 (accession number 22) with the mean value of 11.28 which were in conformity with the findings of Hodgson (1968) and Hossain (1985). The maximum length of segment (19.33 cm) was observed in the fruits of accession number 27 while the minimum (8.33 cm) was recorded in the fruits of accession number 1. The result of length of segments supports the findings of Hossain (1983). The maximum weight of the pulp (1150 g) was obtained in the fruits of accession number 27 whereas the minimum weight of the pulp (295 g) was obtained from accession number 24. The present result agree with the findings of Hossain (1983) who recorded pulp weight to vary from 396 to 1418 g. The cause of variation of the pulp weight is due to size, thickness of the rind and Juice content of the fruit. Total soluble solid (FSS) percentage varied from 6.16% (accession number 16) to 9.66% (accession number 6 and 10) with the mean value of 7.99%. The maximum number of seeds (140) fruit⁻¹ was found in accession number 27 whereas the minimum (20.66) was found from the accession number II with the mean value of 70.88. There was no seedless fruit under the studied accessions but Hossain (1983) found both seedless and seeded fruits where number of seeds varied in the range from 8 to 94 fruit⁻¹ The heaviest seeds (0.59 g) were found from the accession number 26 followed rather closely by those of accession numbers 6 (0.58 g), 10, 19 and 22 (0.54 g) whereas accession number 3 was found to contain the lightest seeds (0.29 g).

Qualitative characteristics: A wide variation was observed (Table 3) in different qualitative characters of 30 pummelo accessions. The shape of the observed fruits was graded into four groups; globose, oblate, ovate and pyriform Only the fruits of accession number 4 was oblate, accession numbers 8, 14 and 19 were pyriform accession number 7, 9, 21, 25 and 28 were ovate while the rest of accessions were globose. A similar observation was

Table 1: Morphological characteristics of 3 local pummelo accessions

Accession	Plant height (m)	Base girth (cm)	Primary branches /plant	Plant growth (m ³)	Tree volume (m ³)	Lamina area (cm ²)	Wing area (cm ²)	Lamina: wing ratio	Leaf length (cm)	Leaf width (cm)
1	274.00	65.33	9.33	11.80	2.80	23.18	0.32	73.31	9.96	4.56
2	286.33	65.33	9.00	13.62	3.24	23.14	0.26	92.22	9.76	4.73
3	322.00	53.66	13.66	19.02	4.61	25.75	0.56	45.70	13.83	6.33
4	457.33	57.66	12.66	48.68	11.60	36.40	1.62	22.58	13.24	6.78
5	380.00	53.00	10.33	28.79	6.90	31.93	5.37	5.95	11.72	5.77
6	260.00	53.00	11.00	10.07	2.42	29.19	3.68	8.02	12.25	5.88
7	396.33	43.66	7.33	13.47	3.21	20.80	0.50	41.60	13.79	7.31
8	456.33	76.66	17.66	61.04	14.60	36.70	1.47	24.92	11.58	5.74
9	328.00	51.33	6.33	14.40	3.43	35.84	1.95	18.42	12.89	6.05
10	357.66	58.33	13.00	31.89	7.59	38.15	0.64	60.05	11.16	6.67
11	321.33	36.66	10.33	8.09	2.02	41.95	2.32	18.40	13.43	6.60
12	344.33	59.33	12.66	26.68	6.37	24.43	1.02	24.54	10.86	5.29
13	298.66	63.00	8.33	17.35	4.13	25.88	1.49	17.39	11.77	5.33
14	189.33	57.33	14.33	12.66	3.02	33.00	1.12	29.68	12.91	6.04
15	333.33	39.00	10.00	19.05	4.55	27.31	2.11	12.96	11.54	5.21
16	386.66	70.33	19.00	33.69	8.03	21.91	1.31	17.50	13.00	5.76
17	390.33	54.00	13.00	31.20	7.42	35.69	0.18	201.11	11.96	6.17
18	415.00	60.33	17.66	44.24	10.53	28.93	0.55	52.91	12.10	6.56
19	410.00	66.33	15.66	33.56	8.00	23.69	0.75	31.94	10.86	5.59
20	373.00	64.33	18.66	33.73	8.03	39.18	1.61	23.76	11.15	5.65
21	332.33	52.33	10.66	14.15	3.38	29.46	1.39	19.22	10.78	5.38
22	427.33	68.00	27.00	59.14	14.24	22.94	0.46	49.91	12.83	5.52
23	356.33	50.66	12.00	16.20	3.86	32.16	1.79	17.96	12.82	5.10
24	310.66	53.33	17.66	21.46	5.13	28.77	1.56	18.77	10.92	5.38
25	343.66	35.66	9.00	21.52	5.14	21.57	0.52	42.36	11.14	5.05
26	412.33	61.00	11.33	45.08	10.79	29.77	3.42	8.72	11.16	5.07
27	376.66	57.66	12.66	34.35	8.20	30.02	0.73	41.32	10.19	4.88
28	362.33	38.00	7.66	12.00	2.92	34.43	1.83	18.79	11.16	4.55
29	405.00	69.33	44.33	52.07	12.52	28.88	1.40	20.65	10.77	4.31
30	385.66	47.00	25.33	20.77	4.97	17.70	0.70	25.17	9.54	4.50
Mean	356.41	56.05	14.25	26.99	6.45	29.29	1.42	36.19	11.70	5.59
SE (X)	22.84	4.74	1.53	3.81	0.91	0.96	0.15	5.54	0.96	0.65
% Cv	7.85	10.36	13.11	17.29	17.23	4.02	13.21	18.77	10.09	14.34

Table 2: Fruit characteristics of 30 local pummelo accessions

Accession	Fruits/plant	Fruit weight (g)	Fruit diameter (cm)	Fruit wt. without rind (g)	Rind thickness (cm)	No. of segments/fruit	Length of weight segments	Pulp weight (g)	TSS (%)	Number of seeds/fruit	Mean weight of one seed (g)
1	17.00	741.66	12.62	479.00	1.53	11.00	8.33	343.33	8.10	53.00	0.48
2	18.00	810.00	11.56	544.00	1.43	12.00	9.53	380.00	8.66	41.00	0.41
3	15.00	903.33	13.11	466.33	1.63	10.33	11.73	368.33	8.80	52.33	0.29
4	14.00	1000.00	13.31	771.66	0.73	10.33	16.50	656.66	8.33	46.00	0.30
5	13.00	796.00	11.10	433.66	1.46	9.66	9.80	365.66	8.26	45.33	0.40
6	17.33	775.00	11.09	501.66	21.20	11.00	11.39	419.33	9.66	52.66	0.58
7	15.66	718.33	12.07	379.66	1.16	10.33	13.83	330.66	7.83	30.00	0.30
8	52.66	1360.00	15.24	961.00	0.76	10.33	18.23	497.66	9.00	53.00	0.41
9	18.00	1451.66	15.54	1076.66	1.03	12.33	17.83	773.33	8.66	135.00	0.38
10	32.00	1041.66	13.65	645.33	1.06	13.00	15.23	499.33	9.66	139.33	0.54
11	18.33	822.66	9.70	378.33	1.53	9.66	9.50	305.00	8.43	20.66	0.40
12	17.66	1049.33	10.13	479.33	1.41	11.33	9.06	425.33	7.26	93.66	0.39
13	18.33	767.33	10.97	430.00	1.23	12.33	9.43	391.33	7.53	30.00	0.43
14	18.66	1222.33	14.41	919.00	1.06	11.66	17.80	689.33	8.43	95.66	0.40
15	16.66	1221.66	14.15	907.33	1.26	11.00	18.66	707.66	7.83	121.66	0.35
16	21.66	856.66	13.91	396.00	2.33	10.00	13.93	316.66	6.16	40.66	0.43
17	16.66	1483.33	16.89	903.66	1.93	12.33	18.50	316.66	7.66	54.00	0.46
18	17.33	1503.33	17.72	834.00	2.53	10.33	15.66	676.66	7.83	94.66	0.51
19	18.00	1346.66	15.28	797.32	1.93	10.00	17.50	623.33	7.66	85.00	0.54
20	20.33	1295.00	16.00	776.66	1.70	9.66	17.43	580.00	7.50	55.66	0.33
21	15.33	1335.66	15.31	1042.66	0.86	12.33	17.83	856.66	8.73	67.00	0.43
22	45.00	1096.66	15.33	878.33	0.73	14.66	15.20	739.00	8.16	62.66	0.54
23	18.00	1173.33	12.77	726.33	0.78	10.00	11.79	498.66	7.26	52.33	0.42
24	28.33	796.66	9.54	396.00	1.63	10.66	14.06	295.33	7.63	30.33	0.39
25	18.00	985.00	13.88	702.33	0.70	12.66	15.13	505.66	6.93	91.66	0.36
26	14.00	1113.33	14.54	764.66	1.30	11.66	16.50	530.00	6.90	93.66	0.59
27	15.00	2160.00	18.94	1419.33	1.60	12.66	19.33	1150.00	7.50	140.00	0.43
28	21.33	1415.66	15.22	1065.00	1.03	12.66	17.80	969.66	8.80	66.33	0.43

Table 2: Continue

Accession	Fruits/plant	Fruit weight (g)	Fruit diameter (cm)	Fruit wt. without rind (g)	Rind thickness (cm)	No. of segments/fruit	Length of weight segments	Pulp weight (g)	TSS (%)	Number of seeds/fruit	Mean weight of one seed (g)
29	28.66	1113.33	14.89	710.00	1.30	11.33	16.16	556.00	7.33	71.33	0.39
30	14.00	1444.00	15.92	951.00	1.50	11.33	17.70	737.33	7.50	123.0	0.44
Mean	20.46	1123.28	13.82	724.21	1.37	11.28	14.71	563.12	7.99	70.88	6.42
SE (x)	2.19	126.51	0.64	77.29	0.13	1.22	0.84	66.15	0.36	8.04	0.04
%CV	13.33	13.79	5.72	13.07	11.99	13.26	6.98	14.39	5.44	13.88	10.25

Table 3: Qualitative characteristics of 30 local pummelo accessions

Accession	Leaf shape	Fruit shape	Skin colour	Smooth ness	Pulp colour	Juiciness	Bitter ness	Sweet ness	Softness	Pulp vesicle size
1	Oblong	Globose	Yellow	Nearly smooth	White	Medium juicy	Slight	Sweet	Medium soft	Medium
2	Oblong	Globose	Yellow	Smooth	Reddish white	Juicy	No	Sweet	Soft	Medium
3	Oblong	Globose	Greenish yellow	Nearly smooth	Reddish	Juicy	No	Less sweet	Soft	Medium
4	Oblong	Oblate	Greenish yellow	Nearly smooth	Reddish	Less juicy	No	Less sweet	Medium soft	Medium
5	Ovate	Globose	Light yellow	Nearly smooth	Pink	Medium juicy	No	Less sweet	Medium soft	Medium
6	Oblong	Globose	Yellow	Nearly smooth	Reddish	Juicy	No	Less sweet	Very soft	Medium
7	Oblong	Ovate	Greenish yellow	Smooth	White	Less juicy	Slight	Less sweet	Medium soft	Medium
8	Oblong	Pyriform	Reddish yellow	Nearly smooth	Reddish	Juicy	No	Less sweet	Soft	Large
9	Oblong	Ovate	Yellow	Smooth	Reddish white	Juicy	No	Less sweet	Soft	Large
10	Ovate	Globose	Greenish yellow	Nearly smooth	White	Juicy	No	Sweet	Soft	Large
11	Oblong	Globose	Greenish yellow	Nearly smooth	Reddish	Medium juicy	No	Sweet	Medium soft	Medium
12	Oblong	Globose	Greenish yellow	Nearly smooth	Pink	Medium juicy	Slight	Less sweet	Soft	Medium
13	Ovate	Globose	Light yellow	Medium rough	Reddish	Medium juicy	No	Sweet	Medium soft	Medium
14	Oblong	Pyriform	Greenish yellow	Nearly smooth	Reddish white	Juicy	No	Sweet	Medium soft	Large
15	Oblong	Globose	Redish yellow	Medium rough	Reddish	Very juicy	No	Sweet	Medium soft	Large
16	Oblong	Globose	Greenish yellow	Rough	Pink	Less juicy	No	Less sweet	Medium soft	Medium
17	Ovate	Globose	Yellow	Medium rough	Pink	Very juicy	No	Sweet	Soft	Large
18	Oblong	Globose	Yellow	Smooth	Reddish white	Less juicy	No	Less sweet	Medium soft	Medium
19	Oblong	Pyriform	Yellow	Smooth	Pink	Juicy	No	Less sweet	Soft	Medium
20	Ovate	Globose	Greenish yellow	Smooth	Pink	Juicy	No	Sour	Medium soft	Medium
21	Ovate	Ovate	Reddish yellow	Nearly smooth	Pink	Very juicy	No	Sweet	Soft	Medium
22	Oblong	Globose	Yellow	Smooth	Reddish white	Juicy	No	Sweet	Soft	Large
23	Oblong	Globose	Light yellow	Nearly smooth	Reddish	Medium juicy	No	Sweet	Medium soft	Medium
24	Oblong	Globose	Yellow	Nearly smooth	Reddish	Medium juicy	Slight	Sweet	Soft	Medium
25	Oblong	Ovate	Yellow	Nearly smooth	Reddish white	Medium juicy	Slight	Less sweet	Medium soft	Small
26	Oblong	Globose	Yellow	Nearly smooth	Pink	Juicy	No	Sweet	Soft	Medium
27	Ovate	Globose	Yellow	Medium rough	Reddish	Less juicy	No	Sour	Medium soft	Large
28	Ovate	Ovate	Greenish yellow	Smooth	White	Juicy	No	Less sweet	Soft	Medium
29	Oblong	Globose	Greenish yellow	Medium rough	White	Juicy	No	Sweet	Soft	Medium
30	Ovate	Globose	Yellow	Nearly smooth	Reddish white	Juicy	No	Sour	Soft	Medium

reported by Guha and Faruque (1988). A wide range of variability was noticed for fruit skin colour at maturity. In most cases, it was greenish yellow, yellow and reddish yellow but the fruit skin of accession number 5, 13 and 23 were light yellow. This variation in case of fruit skin colour was also reported by Azmatullah *et al.* (1987). Only the fruits of accession number 16 was rough skinned whereas others had medium rough, nearly smooth skin. The present results agree with the findings of Hossain (1983) who recorded smooth, medium rough and very rough surface of pummelo fruits. Pulp colour is an important qualitative character and generally red pulped pummelo fruits are preferred by the consumers of Bangladesh (Hoque *et al.*, 1987). In this study, the pulp colour of most of the fruits were reddish, reddish white and pinkish but the fruits of accession number 1, 7, 28 and 29 were white. The result of this study is in agreement with Hossain (1983). The taste and quality of pummelo fruits are determined mostly by the characteristics of

softness, sweetness, bitterness, juiciness and pulp vesicle size. The characteristics of softness were divided into three groups; soft, medium soft and very soft. Very soft pulp were obtained only the accession number 6 while rest accessions showed medium soft and soft pulp character. On the contrary, accession number 20, 27 and 30 were sour whereas accession number 3, 4, 5, 7, 9, 12, 19, 18, 19, 25 and 28 were less sweet and rest were sweet in taste. As regard bitterness, slightly bitter in taste were recorded from the accession number 1, 7, 12, 24 and 25 while rest were no bitter in taste. Juiciness characteristic is one of the most important character of edible quality. Very juicy pulp were observed from the accession number 15, 17 and 21 whereas rest accessions were juicy, medium juicy and less juicy pulp. Pulp vesicle size was categorized into three groups, large, medium and small. Same report was given by Zielinski (1955) in respect of pulp vesicle size. Thus the observation of edible qualities of the present study confirms the observations of the past.

References

- Azmatullah, M., A.M. Abdullah and M.A. Haque, 1987. Studies on the physio-morphological characteristics of ten pummelo cultivars. *Bangla. Hort.*, 16: 12-16.
- Castle, S.W., 1983. Growth, yield and cold hardiness of seven years old "Bears" lemon trees on 27 rootstocks. *Proc. Fla. State Hort. Soc.*, 96: 23-25.
- Cedeno-Maldonado, A., W. Gonzalez and E. Fontanet, 1993. Performance of pummelo clones in the central mountain region of Puerto Rico. *Bull. of Fruit Tree Res. Station*, 24: 14-22.
- Gomez, K.A. and A.A. Gomez, 1984. *Statistical Procedure for Agricultural Research*. (2nd Ed.). John Willey and Sons, New York, pp: 28-192.
- Guha, D. and A.H. Faruque, 1988. A survey on variability of pummeloes grown in Bangladesh. *Bangla. Hort.*, 16: 12-16.
- Hayes, W.B., 1966. *Fruit Growing in India*, (3rd Ed.). Allahabad Agril. Inst. Kistabistan, Allahabad, India, pp: 209.
- Hodgson, R.W., 1968. Horticultural Varieties of Citrus. In: W. Reuther, H.J. Webber and L.D. Batchelor (Eds.). *The Citrus Industry*. Vol. 1. Univ. of Calif Press, Barkeley, USA, pp: 534-537.
- Hoque, A., A.M. Abdullah and A.K.M. Amzad Hossain, 1987. Variability in pummelo fruits grown in the northern region of Bangladesh. *Bangla. J. Agric.*, 12: 59.
- Hossain, M.M., 1983. Morphological studies of different citrus plants. M.Sc. thesis, Bangla. Agril. Univ., Mymensingh, Bangladesh, pp: 112.
- Hossain, M.M., 1985. Studies on morphological characteristics of different groups of citrus plants. M.Sc. Bangla. Agril. Univ., Mymensingh, Bangladesh, pp: 65.
- Verdi, A., 1988. Application of recent taxonomical approaches and new techniques to Citrus breeding. In R. Goran and K. Mendel (Eds.). *Proceedings of the Sixth International Citrus Congress*. Balaban Publishers, pp: 303-315.
- Zielinski, Q.B., 1955. *Modern Systematic Pomology*. W. McBrown Co., Inc., Dubeque, Iowa, pp: 263.