Variability Studies of strains of kagzi lime (*Citrus aurantifolia* Swingle) in Latur district of Maharashtra, India

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Received: 16-11-2016 Accepted: 27-12-2017 DOI: 10.18805/ag.D-4492

**ABSTRACT**

The survey work was undertaken to study the variability in kagzi lime of Latur district during 2010-2011. The strain LTR$_3$ recorded the maximum height of plant (4.22 m), which was on par with LTR$_9$ (4.20 m) and LTR$_3$ (4.18 m). There was a significant variation in tree volume ranging from 8.87 m$^3$ to 57.82 m$^3$. The strain LTR$_7$ was recorded the maximum tree volume (57.82 m$^3$). Maximum number of fruits per tree (2390.00) was recorded in strain LTR$_3$. Maximum fruit weight was recorded in LTR$_1$ (65.33 g), which was on par with strain LTR$_9$ (64.00 g). The fruit volume was recorded maximum in LTR$_7$ (65.00 ml), which was on par with strain LTR$_3$ (64.00 ml). The length of fruit was maximum in LTR$_1$ (4.95 cm), which was on par with LTR$_9$ (4.92 cm), whereas, the maximum breadth of fruit was recorded in strain LTR$_9$ (4.70 cm). The highest shape index of fruit was recorded in LTR$_{13}$ (1.09), which was at par with LTR$_3$ (1.07). Many strains were yellow in colour, oval shaped and smooth in texture.

**Key words:** Fruit characters, Growth, Kagzi lime.

**INTRODUCTION**

Kagzi lime (*Citrus aurantifolia* Swingle) belongs to family Rutaceae, originated in India and it is the third most important citrus species, after Mandarin and Sweet orange. Maharashtra is leading state in acid lime cultivation grown commercially in Vidarbha and Marathwada region. The fruits are extensively used for preparation of squashes, pickles, syrups and cordials, citric acid and for table purpose in daily life of Indians (Cheema *et al.* 1954). The fruits are valued not only for its nutritional qualities but also for medicinal purposes.

Under south and central Indian conditions, normally kagzi lime produces three distinct bahar (crop) viz., Mrig, Haste and Ambe bahar. The varieties like Kagzi limbu, Pat limbu and Godhadi limbu were cultivated in the Maharashtra State (Cheema, *et al.* 1954). However, there are some types which produce fruit almost through the year (Baramsi) and are highly value for summer crop. The citrus industry of Marathwada region have heavy demand for supply of improved kagzi lime seedlings to cultivators. It also indicated great scope for improvement in yield and fruit quality by clone’s selection from the innumerable seedlings already available under cultivation (Jature and Chakrawar, 1981). Considering the importance of kagzi lime a survey was undertaken to study growth and yield attributes of various local genotypes.

**MATERIALS AND METHODS**

The survey was undertaken in the Latur district of Maharashtra during *mrig bahar* 2010-11. Different locations visited from which, LTR$_1$, LTR$_9$, LTR$_3$, LTR$_3$, LTR$_7$, LTR$_7$, LTR$_1$, LTR$_{13}$, LTR$_{13}$, LTR$_{13}$, LTR$_{13}$, LTR$_{13}$, LTR$_{13}$, LTR$_{13}$, LTR$_{13}$, LTR$_{13}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$, LTR$_{22}$ strains were selected for analysis. Observations were recorded for height of tree (m), Tree volume (m$^3$), number of fruits per tree, weight of fruit(g), volume of fruit (ml), yield (kg/tree), colour of fruit, shape of fruit, texture of fruit, length of fruit (cm), breadth of fruit (cm) and shape index of fruit (L/B). The experiment was laid out in randomized block design (RBD) with three replications as per the procedure outlined by Panse and Sukhatme (1967).

**RESULTS AND DISCUSSION**

The data pertaining to Height of tree (m), Tree volume (m$^3$), number of fruits per tree, weight of fruit, volume of fruit (ml), yield (kg/tree), presented in Table 1 were significant among the strains.

**Height of tree (m):** The maximum height of the tree (4.22 m) was recorded in strain LTR$_3$, which was on par with strains LTR$_9$ (4.20 m) and LTR$_3$ (4.18 m). While, strain LTR$_7$ was recorded the lowest height of tree (2.36 m). The maximum height of tree might be due to the more vigorous growth. Madhavi and Babu (2003) observed similar variation in

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height of tree among the seven varieties of sweet orange found the maximum height of tree (4.28 m) in Jaffa and minimum (2.41 m) in Blood Red Malta. Shinde et al. (2004) also reported similar variation in the height. The results of the present study are in conformity with the reports of the above research works.

**Tree volume (m³):** The highest tree volume (57.82 m³) was observed in strain LTR_{16}, which was on par with strain LTR_{15} (55.22 m³). The strain LTR_{12} was recorded the lowest tree volume (8.87 m³). The results on tree volume revealed a wide range from 8.87 to 57.8 m. Singh et al. (1998) studied fruit growth and development in kinnow mandarin and found that maximum tree volume (70.0 m³) was recorded in Trolly and minimum (40.7 m³) in Kharma Khatta. The results found above scientists are in contradiction with present investigation.

**Number of fruits per tree:** The highest number of fruits per tree was recorded in strain LTR_{(2390.00)}, followed by LTR_{15} (2350.00), while, lowest (704.00) was recorded in LTR_{11}. The number of fruits per tree revealed a wide range form 704.00 to 2390.00. The higher number of fruits per tree obtained may be due to more vegetative growth which resulted to high rate of photosynthesis. Swammy et al. (1972) found the significant variation for number of fruits per tree, kagzi lime tree bear fruits from 3000 to 5000 fruits annually, Jature and Chakravar (1981) found significant variation ranged from 600 to 2100. The results obtained in the present investigation are inconformity with the above workers.

**Weight of fruit (g):** The strain LTR_{15} was recorded the highest weight of fruit (65.33 g), followed by strain LTR_{16} (64.00 g) and LTR_{12} (60.00 g). The lowest weight of fruit (31.01 g) was observed in strain LTR_{16}. This might be due to maximum leaf area and tree volume. These result are in conformity with the findings of Jature and Chakravar (1981). Badiyala et al. (1992) and Athani et al. (2009).

**Volume of fruit (ml):** Volume of fruit varied significantly among the strains of kagzi lime. The strain LTR_{15} was recorded the highest volume of fruit (65.00 ml), followed by strain LTR_{16} (64.00 ml). The lowest volume of fruit was observed in strain LTR_{15} (31.00 ml). Trithakar (2004) found the volume of fruit ranged from 33.79 cc to 48.6 cc. Athani et al. (2009) studied kagzi lime strains and found the volume obtained may be due to more vegetative growth which resulted to high rate of photosynthesis.

### Table 1: Growth and yield characters of Kagzi lime(Citrus aurantifolia Swingle) strains

| Strains | Height of tree(m) | Tree volume(m³) | Number of fruits per tree | Weight of fruit (g) | Volume of fruit (ml) | Yield(kg/tree) |
|---------|------------------|-----------------|---------------------------|---------------------|---------------------|----------------|
| LTR_{1} | 3.99             | 53.45           | 2012.00                   | 53.20               | 52.74               | 107.03         |
| LTR_{2} | 4.08             | 50.95           | 1778.00                   | 64.00               | 64.00               | 113.70         |
| LTR_{3} | 3.95             | 50.69           | 2005.00                   | 52.85               | 52.27               | 105.96         |
| LTR_{4} | 3.58             | 36.43           | 1938.00                   | 47.02               | 46.68               | 94.88          |
| LTR_{5} | 4.22             | 53.52           | 2390.00                   | 50.00               | 40.50               | 132.71         |
| LTR_{6} | 3.29             | 26.22           | 1975.00                   | 42.94               | 43.54               | 84.80          |
| LTR_{7} | 3.45             | 29.88           | 2110.00                   | 41.58               | 41.21               | 87.73          |
| LTR_{8} | 4.20             | 55.22           | 2350.00                   | 56.50               | 57.36               | 132.71         |
| LTR_{9} | 3.78             | 41.32           | 2000.00                   | 53.00               | 52.50               | 106.00         |
| LTR_{10}| 2.80             | 17.79           | 1001.00                   | 40.60               | 40.60               | 106.00         |
| LTR_{11}| 3.82             | 52.45           | 1600.00                   | 65.33               | 65.00               | 104.52         |
| LTR_{12}| 3.01             | 8.87            | 1557.00                   | 44.28               | 45.68               | 68.94          |
| LTR_{13}| 4.18             | 49.34           | 2120.00                   | 52.50               | 52.90               | 111.50         |
| LTR_{14}| 2.88             | 23.73           | 945.00                    | 52.00               | 51.70               | 49.14          |
| LTR_{15}| 3.24             | 20.78           | 1500.00                   | 51.13               | 50.90               | 76.54          |
| LTR_{16}| 2.36             | 13.19           | 704.00                    | 31.01               | 31.00               | 21.38          |
| LTR_{17}| 3.18             | 19.94           | 1405.00                   | 43.00               | 43.02               | 60.41          |
| LTR_{18}| 3.28             | 30.99           | 1540.00                   | 49.01               | 49.00               | 75.47          |
| LTR_{19}| 3.98             | 57.82           | 1910.00                   | 56.70               | 56.05               | 108.20         |
| LTR_{20}| 3.97             | 51.92           | 2030.00                   | 52.50               | 52.63               | 106.16         |
| LTR_{21}| 3.28             | 28.14           | 1798.00                   | 46.01               | 46.02               | 82.72          |
| LTR_{22}| 3.84             | 47.86           | 2100.00                   | 50.43               | 50.36               | 105.90         |
| LTR_{23}| 3.29             | 33.48           | 1527.00                   | 55.00               | 54.90               | 83.98          |
| LTR_{24}| 3.54             | 34.01           | 1700.00                   | 54.80               | 54.60               | 93.16          |
| LTR_{25}| 3.20             | 27.73           | 1705.00                   | 40.65               | 40.32               | 69.30          |
| LTR_{26}| 3.92             | 39.07           | 2050.00                   | 50.60               | 50.53               | 103.73         |
| LTR_{27}| 3.14             | 24.57           | 993.00                    | 50.16               | 50.28               | 49.80          |
| LTR_{28}| 3.93             | 47.44           | 2040.00                   | 51.90               | 51.10               | 105.87         |
| S.E. 2  | 0.130            | 4.83            | 80.72                     | 2.87                | 2.58                | 5.24           |
| C.D. at 5% | 0.361        | 13.36           | 223.2                     | 7.95                | 7.14                | 14.51          |
| C.V. (%) | 9.36            | 12.73           | 10.12                     | 10.98               | 9.90                | 10.19          |
of fruit ranged from (20.3 to 65.3 ml). The results obtained in the present investigation are inconformity with above findings.

**Yield (kg/tree):** The highest fruit yield (144.59 kg/tree) was observed in strain LTR<sub>1</sub>, followed by strain LTR<sub>2</sub> (132.71 kg/tree) and strain LTR<sub>3</sub> (113.70 kg/tree) respectively, while the lowest fruit yield was found in strain LTR<sub>28</sub> (21.83 kg/tree). The higher yield was due to more number of fruits. Jature and Chakrawar (1981) studied 89 kagzi lime strains and found the ND 1, ABD 3, PBN 8 and PBN 12 were highly productive range of variation 136 to 175 kg per plant. Badiyala et al. (1992) studied kagzi lime strains and found a range of variation in (30.00 kg to 195.00 kg per tree). Rampise et al. (1995) evaluation acid lime clones in two year and revealed that the yield varied from (0.40 to 4.40 kg/tree).

**Fruit characters:** The observations pertaining to fruit characters viz., Colour of fruit, Shape of fruit, Texture of fruit, Length of fruit (cm), Breadth of fruit (cm) and Shape index of fruit (L/B) presented in Table 2 were significant.

**Colour of fruit:** The results revealed variation in colour of fruit. The fruit of strain LTR<sub>1</sub>, LTR<sub>2</sub>, LTR<sub>7</sub>, LTR<sub>22</sub>, LTR<sub>24</sub>, LTR<sub>26</sub>, and LTR<sub>27</sub> were yellow in colour, whereas, strain LTR<sub>4</sub> and LTR<sub>8</sub> showed dark yellow coloured fruits. Strains LTR<sub>5</sub>, LTR<sub>9</sub>, LTR<sub>10</sub>, LTR<sub>12</sub>, LTR<sub>13</sub>, LTR<sub>14</sub>, LTR<sub>15</sub>, LTR<sub>16</sub>, LTR<sub>17</sub>, LTR<sub>19</sub>, LTR<sub>20</sub>, LTR<sub>21</sub>, LTR<sub>23</sub>, LTR<sub>24</sub>, LTR<sub>26</sub>, and LTR<sub>28</sub> showed greenish coloured fruits. Strains LTR<sub>6</sub>, LTR<sub>11</sub>, LTR<sub>18</sub>, and LTR<sub>19</sub> showed light yellow coloured fruits. This might be caused due to the genetical difference among the strains of kagzi lime and similar study was conducted by Badiyala et al. (1992) observed yellow coloured fruits in strain Primrose 601/1.

**Shape of fruit:** Oval shape was observed in fruits of strains LTR<sub>1</sub>, LTR<sub>2</sub>, LTR<sub>7</sub>, LTR<sub>12</sub>, LTR<sub>13</sub>, LTR<sub>14</sub>, LTR<sub>15</sub>, LTR<sub>16</sub>, LTR<sub>17</sub>, LTR<sub>21</sub>, LTR<sub>22</sub>, and LTR<sub>28</sub>. Round shaped fruits were found in strains LTR<sub>6</sub>, LTR<sub>10</sub>, LTR<sub>19</sub>, LTR<sub>20</sub>, LTR<sub>23</sub>, LTR<sub>24</sub>, LTR<sub>26</sub>, and LTR<sub>28</sub>. Spherical shape fruits were found in strain LTR<sub>4</sub>. It might be due to genetical difference of the kagzi lime strains. Many research workers, Aulakh et al. (1992) found round shape of fruit in Dhaulakuan-18, Jature and Chakrawar (1981) found most of the strains were oval (47.19 %) and round (24.71 %) in shape. Bagde and Patil (1989) reported round shape of fruits in Chakradhar lime.

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**Table 2:** Physical characters of fruits of Kagzi lime(Citrus aurantifolia Swingle) strains

| Strains | Colour  | Shape    | Texture | Length (cm) | Breadth (cm) | Shape index (L/B) |
|---------|---------|----------|---------|-------------|--------------|-------------------|
| LTR<sub>1</sub> | Yellow  | Oval     | Smooth  | 4.56        | 4.56         | 1.06              |
| LTR<sub>2</sub> | Dark yellow | Oval   | Smooth  | 4.50        | 4.26         | 1.05              |
| LTR<sub>3</sub> | Greenish | Oval     | Rough   | 4.46        | 4.15         | 1.07              |
| LTR<sub>4</sub> | Yellow  | Oval     | Rough   | 4.44        | 4.25         | 1.04              |
| LTR<sub>5</sub> | Yellow  | Oval     | Smooth  | 4.85        | 4.50         | 0.07              |
| LTR<sub>6</sub> | Light yellow | Round | Smooth  | 4.56        | 3.99         | 1.10              |
| LTR<sub>7</sub> | Yellow  | Oval     | Smooth  | 4.04        | 3.98         | 1.00              |
| LTR<sub>8</sub> | Yellow  | Oval     | Smooth  | 4.92        | 4.70         | 1.04              |
| LTR<sub>9</sub> | Greenish | Oval     | Rough   | 4.50        | 4.20         | 1.07              |
| LTR<sub>10</sub> | Greenish | Round    | Rough   | 4.00        | 3.89         | 1.02              |
| LTR<sub>11</sub> | Dark yellow | Oval   | Very smooth | 4.95  | 4.54         | 1.09              |
| LTR<sub>12</sub> | Yellow  | Oval     | Round   | 4.02        | 3.99         | 1.00              |
| LTR<sub>13</sub> | Yellow  | Spherical | Smooth  | 4.36        | 4.56         | 0.90              |
| LTR<sub>14</sub> | Light yellow | Oval  | Rough   | 4.41        | 4.19         | 1.05              |
| LTR<sub>15</sub> | Greenish | Oval     | Very smooth | 4.53  | 4.31         | 1.05              |
| LTR<sub>16</sub> | Yellow  | Oval     | Smooth  | 3.75        | 3.70         | 1.01              |
| LTR<sub>17</sub> | Greenish | Oval     | Smooth  | 4.07        | 4.05         | 1.00              |
| LTR<sub>18</sub> | Light yellow | Oval  | Smooth  | 4.56        | 4.33         | 1.05              |
| LTR<sub>19</sub> | Yellow  | Oval     | Smooth  | 4.85        | 4.60         | 1.05              |
| LTR<sub>20</sub> | Greenish | Oval     | Rough   | 4.35        | 4.17         | 1.04              |
| LTR<sub>21</sub> | Greenish | Oval     | Rough   | 4.37        | 4.20         | 1.04              |
| LTR<sub>22</sub> | Yellow  | Oval     | Round   | 4.53        | 4.04         | 1.01              |
| LTR<sub>23</sub> | Yellow  | Oval     | Smooth  | 4.85        | 4.65         | 1.04              |
| LTR<sub>24</sub> | Light yellow | Oval  | Smooth  | 4.75        | 4.55         | 1.04              |
| LTR<sub>25</sub> | Greenish | Oval     | Rough   | 3.90        | 3.86         | 1.01              |
| LTR<sub>26</sub> | Yellow  | Oval     | Smooth  | 4.53        | 4.07         | 1.01              |
| LTR<sub>27</sub> | Yellow  | Oval     | Smooth  | 4.60        | 4.30         | 1.06              |
| LTR<sub>28</sub> | Greenish | Oval     | Rough   | 4.58        | 4.44         | 1.03              |

S.E. : 0.2

C.D. at 5% : 0.193

C.V. (%) : 12.30
Texture of fruit: The result revealed that, variation in texture of fruits. The fruit of strains LTR_1, LTR_2, LTR_3, LTR_4, LTR_5, LTR_6, LTR_7, LTR_8, LTR_9, LTR_10, LTR_11, LTR_12, LTR_13, LTR_14, LTR_15, LTR_16, LTR_17, LTR_18, LTR_19, LTR_20, LTR_21, LTR_22, and LTR_23 were smooth in texture, whereas, strains LTR_2, LTR_3, LTR_4, LTR_5, LTR_6, LTR_7, LTR_8, LTR_9, LTR_10, LTR_11, LTR_12, LTR_13, LTR_14, LTR_15, LTR_16, LTR_17, LTR_18, LTR_19, LTR_20, LTR_21, LTR_22, and LTR_23 showed smooth very texture of fruits. Badiyala et al. (1992) studied sixty seven kagzi lime strains and found the fruits of Primose 601/1 had smooth and rough rind appeal. Singh et al. (2009) observed smooth, rough, semi smooth and very smooth texture fruits.

Length of fruit (cm): Length of fruit varied significantly among the strains of kagzi lime. The results on length of fruit revealed a wide ranged from 3.75 cm to 4.95 cm. The strain LTR_22 recorded the maximum length of fruit (4.95 cm), which was on par with LTR_4 (4.92 cm). The minimum length of fruit was observed in strain LTR_10 (3.75 cm). Tirthakar et al. (2004) studied forty-eight acid lime cultivars and found the maximum length of fruit (5.20 cm) in Dongargaon which was on par with Kanheri (5.12 cm), while minimum in Maispur (3.52 cm).

Breadth of fruit (cm): Breadth of fruit was varied significantly among the kagzi lime strains. Breadth of fruit revealed a wide ranged from 3.70 to 4.70 cm. In this respect strain LTR_9 had highest breadth of fruit (4.70 cm) followed by strain LTR_23 (4.65 cm) and lowest breadth of fruit (3.70 cm) in strain LTR_16. Arora and Daulta (1981) found the maximum breadth of fruit (5.84 cm) in seedless kagzi lime followed by barami (5.59 cm). Tirthakar et al. (2004) found the maximum breadth of fruit (5.10 cm) in Dongargaon followed by Kanheri (4.75 cm), while minimum in Maispur (4.13 cm).

Shape index of fruit (L/B): Shape index of fruit varied significantly among the strains of kagzi lime. The strain LTR_1 was recorded the highest shape index of fruit (1.09) which was on par with strains LTR_3 and LTR_1 (1.07) and lowest shape index of fruit was observed in strain LTR_18 (0.07). Similar study was conducted by Jature and Charawar (1981) found a range of variation for shape index of fruit ranged from 0.83 to 2.00. Prasad (1989) reported that fruit shape index was maximum (1.03) in clone No.5 and minimum(0.81) in clone No.29. The results obtained in the present investigation are inconformity with the above findings.

CONCLUSION

It can be summarized that, out of 28 strains of kagazi lime studied, the strain LTR_1 was found most suitable for cultivation in Latur District of Maharashtra as it has performed well with higher yield (144.6 kg/tree), more number of fruits (2390/tree) and fruit weight (60.00g/fruit).

REFERENCES

Arora, R.K. and Daulta, B.S. (1981). Evaluation of some Lemon cultivars (Citrus limon Burm) for their physico-chemical composition and yield under Hissar conditions. Haryana J. Hort. Sci., 10: 182-185.

Athani, S.I., Revanappa and Allolli, T.B. (2009) Variability of physical characters, quality and yield of kagzi lime (Citrus aurantifolia). Journal of Ecobiology., 25: 259-262.

Aulakh, P.S., Sarowa, P.S and Pal, B. (1992). Performance of some Citrus cultivation under arid irrigated region of Punjab. Punjab Hort. J., 1: 1-4.

Bagde, T.R. and Patil, V.S. (1989). Chakradhar lime a new thorn less and seedless selection in lime (Citrus aurantifolia Swingle) strains of punova valley of Himachal Pradesh. Punjab Hort. J., 52: 5-9.

Cheema, G.S., Bhat, S.S., and Naik, K.C. (1954). Commercial fruits of India. Macmillan and Co. Ltd., Calcutta, Bombay, Madras, London, PP. 142-146, 258-260, 278.

Jature, S.D. and Chakrawar, V.R. (1981). Studies on certain strains of Kajazi lime (Citrus aurantifolia Swingle) fruits for their yield and physico-chemical characters. J. Maharashtra agric. Univ., 6: 91-93.

Jature, S.D. and Chakrawar, V.R. (1981). Variability studies on kagzi lime strains. Punjab Hort. J., 2: 157-160.

Madhavi, M and Babu, K.H. (2003). Performance of certain sweet orange varieties in Andhra Pradesh. Madras Agric J., 90: 560-562.

Panse, V.G. and Sukhatme, P.V. (1967). Statistical Methods for Agricultural Workers, Indian Council of Agricultural Research, New Delhi.

Prasad, M.B.N.V. (1989). Clonal variability for physic-chemical fruit characters in acid lime. South Indian Hort., 37: 71-74.

Ranpise, S.A., Desai, U.T., Kale, P.N., Musmade, A.M., Choudhuri, S.M. and Rajadav, S.B. (1995). Performance of acid lime selection from western Maharashtra. Indian J. Hort., 52: 167-169.

Shinde, N.N., Jature, S.D., Patil, M.B and Shinde V.N. (2004) Seedless lime a promising mutant of acid lime. J. Maharastra agric. Univ., 29: 227-228.

Singh, H.K.P., Singh, S.N and Dhatt, A.S. (1998). Studies on fruit growth and development in kinnow. Indian J. Hort., 55: 177-182.

Swamy, G.S., Subba, Rao, Ramayya, N. and Dayanand, T. (1972). Latest trends in citruscultural in Andhra Pradesh. First All India Citrus Seminar on citrusculture. Nagpur,PP. 54-57.

Tirthakar, S.S., Kuchanwar, O.D., Sarode, P.S. and Wagh, S.P. (2004). Fruit quality of acid lime orchard (Citrus aurantifolia) in Akola district. P.K.V. Research J., 28: 158-161.