

PERFORMANCE OF TORIA (*BRASSICA COMPESTRIS* SYN. *RAPA* L.) VARIETY: RAJ VIJAY TORIA-2 IN CENTRAL, EASTERN AND NORTH-EASTERN STATES OF INDIA UNDER RAINFED CONDITION

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ABSTRACT

Performance of developed genotype RMT 08-2 was evaluated in central, eastern and north-eastern states of India under rain-fed condition for quantitative and qualitative traits. It gave highest seed yield over checks in zone III and V. Morphologically plants were erect, medium spreading in nature and primary branches with dichotomous habit. Plants height ranged from 107-124 (cm) which matured in 82-112 days. Mature seeds were round in shape and blackish brown in colour. No significant difference between RVT-2 and checks were observed for test weight trait. An average oil yield 485 (kg/h) was recorded over 7 places which was 10% higher than both checks *i.e.* 14.12% and 11.24% under AICRP trials. Maximum seed yield was obtained on farmers field during 2013-14 and 2014-15 which was 1500 (kg/h) and 1215 (kg/h) that is 33.42% and 26.30% respectively over farmers own seeds. At Morena center, highest seed yield (1753 kg/h) over Bhawani (1512 kg/h) was 15.94% higher than check whereas RVT-2 gave 2245 (kg/h) against Bhawani (1975 kg/h) which was 13.67% higher. DNA finger printing indicated that primers PUT-19, PUT-96, PUT-149, PUT-169, PUT-181 and PUT-271 are useful in generating unique profile of RVT-2 containing 27 bands for its discrimination from other varieties.

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KEY WORDS : AVT: Advance Varietal Trial, DNA finger printing, IVT: Initial Varietal Trial, RVT-2: Raj Vijay Toria-2.

Introduction

Toria (*Brassica campestris* Syn. *rapa* L.) is a most important crop of rabi season of Assam, Bihar, Orissa, and West Bengal. It is an early-maturing crop and well adapted to the short-season and innate high temperature tolerance during germination and seedling stages, and it is successfully grown as catch crop in parts of Haryana, Himachal Pradesh, Madhya Pradesh, Chhattisgarh, Punjab, Uttarakhand and Uttar Pradesh also. The genetic improvement has proceeded following conventional breeding approaches appropriate to their mating system. The out-crossing nature of this species makes recurrent selection the method of choice for cultivar development. The resulting cultivars are heterozygous and heterogeneous; genetically narrow populations³. Even though, the average productivity of toria is quite low. Therefore, there is a big challenge before the plant breeders to sustain the present yield levels of this crop.

The success in crop improvement depends upon the nature and magnitude of variability available in the

genetic resources. In Northern India, especially hilly tract presents rich diversity of oilseed *Brassicaceae*¹. At Morena, collections of *B. rapa* (toria) has reflected considerable variability for different traits including a few unique features like extra earliness, dwarf stature and branching patterns.

This paper described the performance of developed variety RVT 2 in central, eastern and north-eastern states under rain-fed condition and characterization by DNA finger printing profile.

Materials and Methods

This variety was developed from composite (JMT01+MRNT-20+T-9+JMT08+JMT 04-1) under all India Coordinated Research Project on Rapeseed and Mustard [ICAR], Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Zonal Agricultural Research Station, Morena and tested under ACRIP net-work as directed by the Directorate of Rapeseed Mustard Research [ICAR], Bharatpur.

RVT-2 (RMT 08-2) was tested in 13 locations under

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TABLE-1: Performance of proposed variety RVT 2 (RMT 08-2) for seed yield (kg/h) in IVT coordinated trials during 2011-12 in Zone III

| Variety/check | Seed yield (kg/h) | | | | Mean (kg/h) | % superiority Over check |
|---------------|-------------------|------|------|------|----------------|-----------------------------|
| | FZB | MOR | PNT | KPR | | |
| RMT 08-2 | 1967 | 1062 | 1544 | 1312 | 1471* | 10.60 |
| PT-303(NC) | 1071 | 1012 | 1327 | 1312 | 1330 | 11.34 |
| Bhawani (ZC) | 1913 | 864 | 1153 | 1350 | 1320 | |

Mean values of Faizabad, Morena, Pantnagar, Kanpur Zone III (APR 2012)² pPB22

NC – National check, ZC- Zonal check

IVT U.P., M.P., Chhattisgarh, Bihar, West Bengal, Orissa, Assam and N.E. Hill State (Imphal and Tripura) and also under station trial and farmers fields.

Each year, the seed material was sown in RBD with 3 replications. The size of each plot was 5.0 M x 1.5 M in IVT with 30 cm row to row and 10 cm plant to plant distance. The observations were recorded on randomly selected 10 plants. Mean data were collected for

quantitative characters viz; Plant type, days to maturity, plant height (cm), number of primary branches/plant, number of secondary branches/plant, number of siliqua/plant, number of seeds/siliqua, Siliqua length (cm), 1000 seed weight (g), oil content (%), oil yield (kg/h), seed yield/plant (g) and also took observations on the incidence of white rust, downy mildew, *Sclecrotinia* stem rot and aphid infestation.

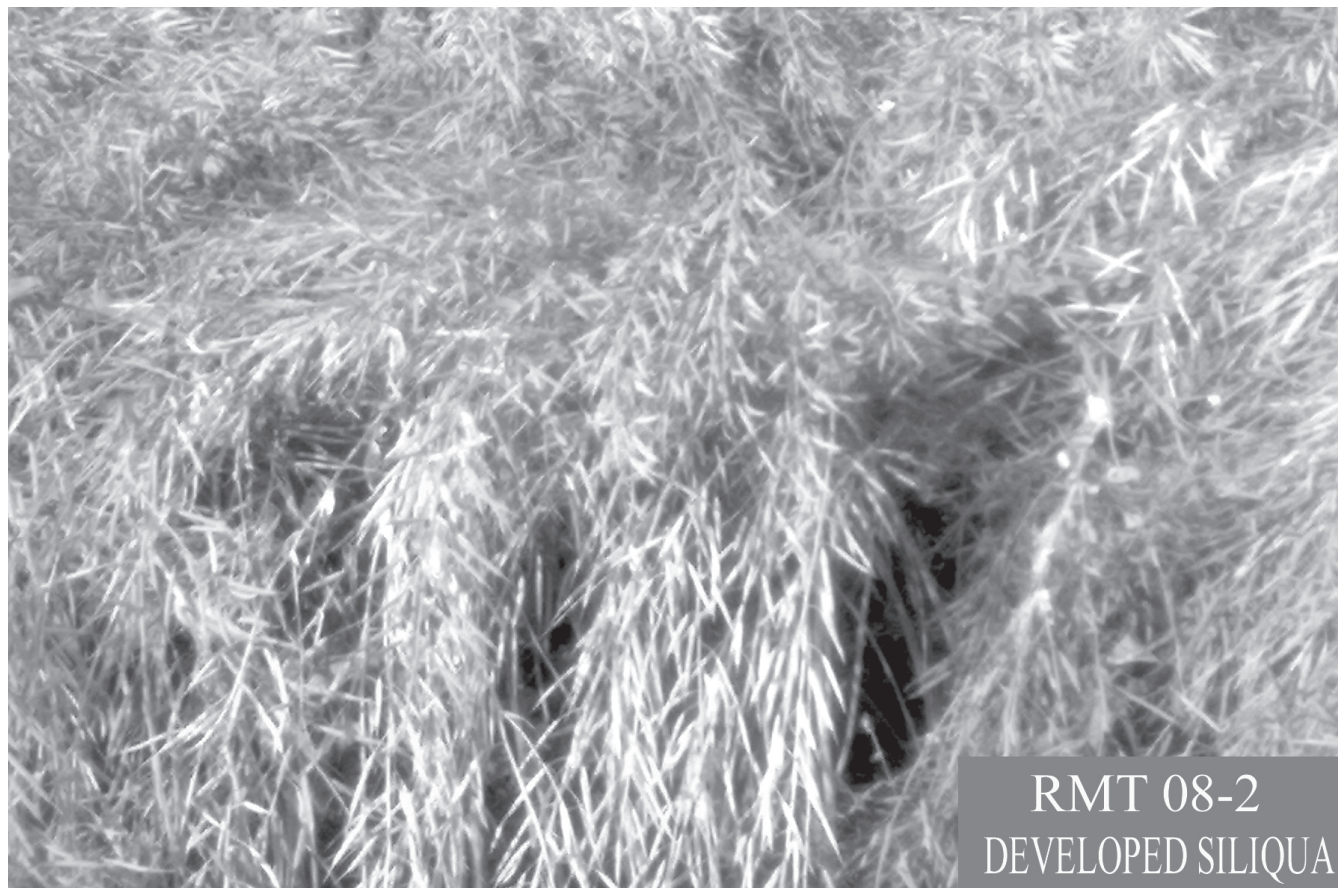


Fig. 1 : Developed Siliquae of Toria variety RVT-2 (RMT 08-2).

TABLE-2 : Performance of proposed variety RVT 2 (RMT 08-2) for seed yield (kg/h) in IVT coordinated trials under rainfed condition during 2011-12 in Zone V

| Variety/check | Seed yield (kg/h) | | | | | | | Mean (kg/h) | % superiority Over check |
|---------------|-------------------|-------|-----|-------|------|-----|------|-------------|--------------------------|
| | BER | BHU** | DOL | IMP** | JAG | KNK | SHL | | |
| RMT 08-2 | 885 | 1150 | 963 | 233 | 2578 | 477 | 1070 | 1195* | 15.35 |
| PT-303(NC) | 917 | 1127 | 979 | 507 | 1667 | 507 | 1111 | 1036 | 11.16 |
| Panchali (ZC) | 888 | 1242 | 782 | 778 | 2189 | 481 | 1037 | 1075 | |

Strain out yield the best check by >10% on the basis of yield.

**Data not included in computation because of low yield than the state average of yield.

The calculations of mean, critical difference and oil content (%) analysis were performed^{5,6}. Moreover, the potentiality of this variety was also tested under ACRIP-net work and on farmer's fields in order to know its performance under normal sown condition in Chambal region with recommended dose of fertilizers.

Molecular characterization of RVT-2:

g-DNA extraction and PCR conditions: g-DNA

was extracted from 100mg of germinated seedlings tissues⁴. Briefly dissolved g-DNA was used as template in of reaction volume containing 1U *Taq* DNA polymerase (Fermentas), 1 X PCR buffer (Fermentas), 0.5mM primers (IDT) and 0.2 mM of dNTP mix (Fermentas). The total volume was adjusted with nuclease free water (*In vitro gen*).

For PCR, the "Touchdown" thermal cycling

TABLE-3 : Performance of proposed variety RVT 2 (RMT 08-2) for days to maturity in IVT coordinated trials under rainfed condition during 2011-12 in Zone V

| Variety/check | Days to maturity | | | | | | | Mean (kg/h) |
|---------------|------------------|-----|-----|-----|-----|-----|-----|-------------|
| | BER | BHU | DOL | IMP | JAG | KNK | SHL | |
| RMT 08-2 | 82 | 88 | 102 | 112 | 88 | 100 | 112 | 99 |
| PT-303(NC) | 87 | 78 | 101 | 112 | 88 | 98 | 102 | 97 |
| Panchali (ZC) | 97 | 95 | 101 | 111 | 86 | 98 | 100 | 97 |

NC – National check, ZC- Zonal check

TABLE-4: Performance of proposed variety RVT 2 (RMT 08-2) for 1000 seed weight (g) in IVT coordinated trials under rainfed condition during 2011-12 in Zone V.

| Variety/check | 1000 seed weight (g) | | | | | | | Mean (kg/h) |
|---------------|----------------------|-----|-----|-----|-----|-----|-----|-------------|
| | BER | BHU | DOL | IMP | JAG | KNK | SHL | |
| RMT 08-2 | 3.1 | 3.4 | 3.7 | 3.6 | 2.5 | 2.7 | 4.1 | 3.3 |
| PT-303(NC) | 3.2 | 3.3 | 4.3 | 3.8 | 2.6 | 2.5 | 3.3 | 3.3 |
| Panchali (ZC) | 3.1 | 3.7 | 3.6 | 3.7 | 2.6 | 2.7 | 3.5 | 3.3 |

TABLE-5: Performance of proposed variety RVT 2 (RMT 08-2) for oil content (%) and oil yield (kg/h) in IVT coordinated trials under rain-fed condition during 2011-12 in Zone V.

| Variety/check | Oil content (%) | | | | | | | Mean (kg/h) | Oil yield (kg/h) | % superiority Over check |
|---------------|-----------------|------|------|------|------|------|------|----------------|------------------------|-----------------------------------|
| | BER | BHU | DOL | IMP | JAG | KNK | SHL | | | |
| RMT 08-2 | 40.4 | 40.4 | 41.0 | 39.5 | 41.8 | 40.3 | 40.5 | 40.6 | 485* | 14.12 |
| PT-303(NC) | 42.8 | 40.9 | 41.5 | 40.3 | 41.9 | 40.9 | 40.0 | 41.2 | 425 | 11.24 |
| Panchali (ZC) | 42.5 | 41.7 | 42.2 | 37.3 | 41.1 | 40.9 | 40.5 | 40.9 | 436 | |

Zone V: Chhattishgarh- Raipur, Jagdalpur, Bihar- Dholi, Jharkhand- Kanke (Rachi), West Bengal- Berhampore, Orissa- Bhubaneswar, Assam- Shillongani, N.E.Hill State- Imphal, Tripura.

conditions were followed: initial denaturation at 94°C for 5 min; 5 cycles of 30s at 94°C, 45s at 61°C with a 1°C decrease in annealing temperature per cycle, and 1 min at 72°C; 30 cycles of 30s at 94°C, 45s at 57°C, and 1 min at 72°C and a final extension at 72°C for 10 min. After completion of amplification cycle, samples were then stored at 4°C. Total 14 primers namely; PUT-19, PUT-96,

PUT-149, PUT-168, PUT-169, PUT-171, PUT-181, PUT-194, PUT-195, PUT-199, PUT-213, PUT-219, PUT-271 and PUT-267 were used to generate DNA profile.

Gel-electrophoresis: The PCR products were mixed with 1x loading dye (Orange-G) and 5 ml of resultant samples were electrophoresed on 3% metaphor agarose gel at constant 80V for 3 hours. After completion of

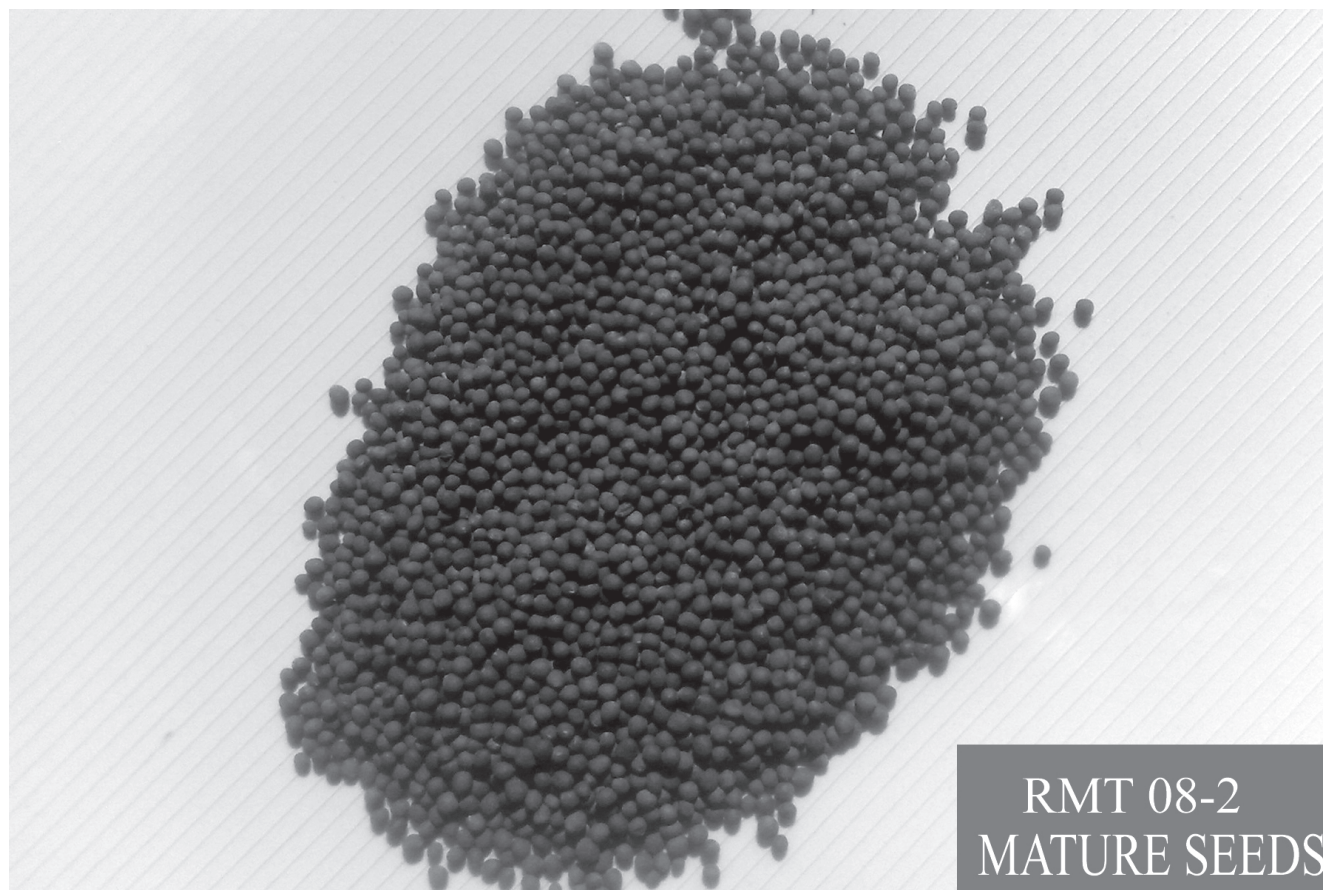


Fig. 2 : Mature seeds of Toria variety RVT-2 (RMT 08-2).

electrophoresis, the ethidium bromide stained gels were visualized under UV light in Gel documentation system. This work was accomplished in collaboration with ICAR-NBPGR, New Delhi on October 5, 2017.

Results and Discussion

RVT-2 variety gave highest seed yield (1967 kg/h) against check PT-303 (1071 kg/h) whereas an average seed yield of Faizabad, Morena, Pantnagar and Kanpur gave 1471 (kg/h) seed yield over check PT-303 (1071 kg/h) Bhawani 1913 kg/h); which is 10.60% and 11.34% respectively in IVT trial under AICRP network under zone III² (Table 1). In another zone V, at Jalgaon, the maximum seed yield (2578 kg/h) was obtained followed by Bhubaneswar (1150 kg/h) and Shillongani (1070 kg/h). Similar case was observed in checks also. An average of 07 places, maximum seed yield of RMT 08-2 was 1195 (kg/h) over checks-PT-303 (1036 kg/h) and Panchali (1075 kg/h) which is 15.35 % and 11.16% respectively (Table 2). This was due to more no. of primary branches/plant, no. of secondary branches/plant, no. of silique /plant, siliqua length (cm), no. of seeds/siliqua and 1000 seed weight (g) contributed to enhance seed yield of toria. Similar observations were reported^{8,9,10}. Selection of no. of silique/plant, no. of seeds/siliqueae indicated that selection with these characters might be right approach for enhancing seed yield of new genotype⁷. Earliest maturity was noticed at Berhampore (82 days) followed by Bhubaneswar (88 days). Interestingly, check variety PT-303 was matured in 78 days and whereas, other check-Panchali was matured in 95 days. An average of 7 places, RMT-02 matures in 99 days than both checks PT-303 and Panchali (97 days). Other character 1000 seed weight (g) indicated that there was no difference between RVT-2 and checks (Table 4).

An average oil yield of RVT-2 of 7 places were found 485 (kg/h) which is 10% higher than both checks *i.e.* 14.12% and 11.24% higher over checks under AICRP trials¹ (Table 5) which confirms the findings reported earlier¹¹. Maximum seed yield was obtained on farmers field during 2013-14 and 2014-15 which was 1500 (kg/h) and 1215 (kg/h) that is 33.42% and 26.30% respectively over farmers own seeds. Plants showed moderate resistance to white rust. Testing results of RVT-2 at Morena center showed highest seed yield (1753 kg/h) over Bhawani (1512 kg/h) which was 15.94% against check during 2011-12 whereas during 2012-13, RVT-2 gave 2245 (kg/h) against Bhawani (1975 kg/h) which was 13.67%. This is due to more no. of primary and secondary branches/plant and more number of seeds/siliqua which confirms the results reported earlier⁹.

Morphologically plants are erect, medium

TABLE-6: Allele size of the markers in Raj Vijay Toria-2 along with controls (Basant and PM-67).

| Genic-SSR primers | Size (bp) | Basant | PM-67 | RVT-2 |
|-------------------|-----------|--------|-------|-------|
| PUT-149 | 338 | 0 | 0 | 1 |
| | 298 | 1 | 1 | 0 |
| PUT-181 | 174 | 1 | 1 | 0 |
| | 153 | 0 | 0 | 1 |
| | 138 | 0 | 0 | 1 |
| | | | | |
| PUT-199 | 1318 | 0 | 0 | 1 |
| | 998 | 1 | 1 | 0 |
| | 951 | 0 | 0 | 1 |
| | | | | |
| PUT-219 | 902 | 1 | 1 | 1 |
| PUT-96 | 372 | 1 | 1 | 0 |
| | 338 | 0 | 0 | 1 |
| PUT-271 | 496 | 0 | 0 | 1 |
| | 438 | 1 | 1 | 1 |
| PUT-213 | 471 | 1 | 1 | 1 |
| PUT-267 | 369 | 1 | 1 | 1 |
| PUT-171 | 700 | 1 | 1 | 1 |
| PUT-169 | 762 | 1 | 1 | 1 |
| | 688 | 1 | 1 | 0 |
| | 638 | 0 | 0 | 1 |
| | | | | |
| PUT-195 | 410 | 0 | 0 | 1 |
| | 371 | 1 | 1 | 1 |
| PUT-168 | 144 | 1 | 0 | 0 |
| | 138 | 0 | 1 | 1 |
| PUT-194 | 161 | 1 | 1 | 1 |
| PUT-19 | 429 | 0 | 1 | 0 |
| | 393 | 0 | 1 | 0 |
| | 386 | 1 | 0 | 1 |

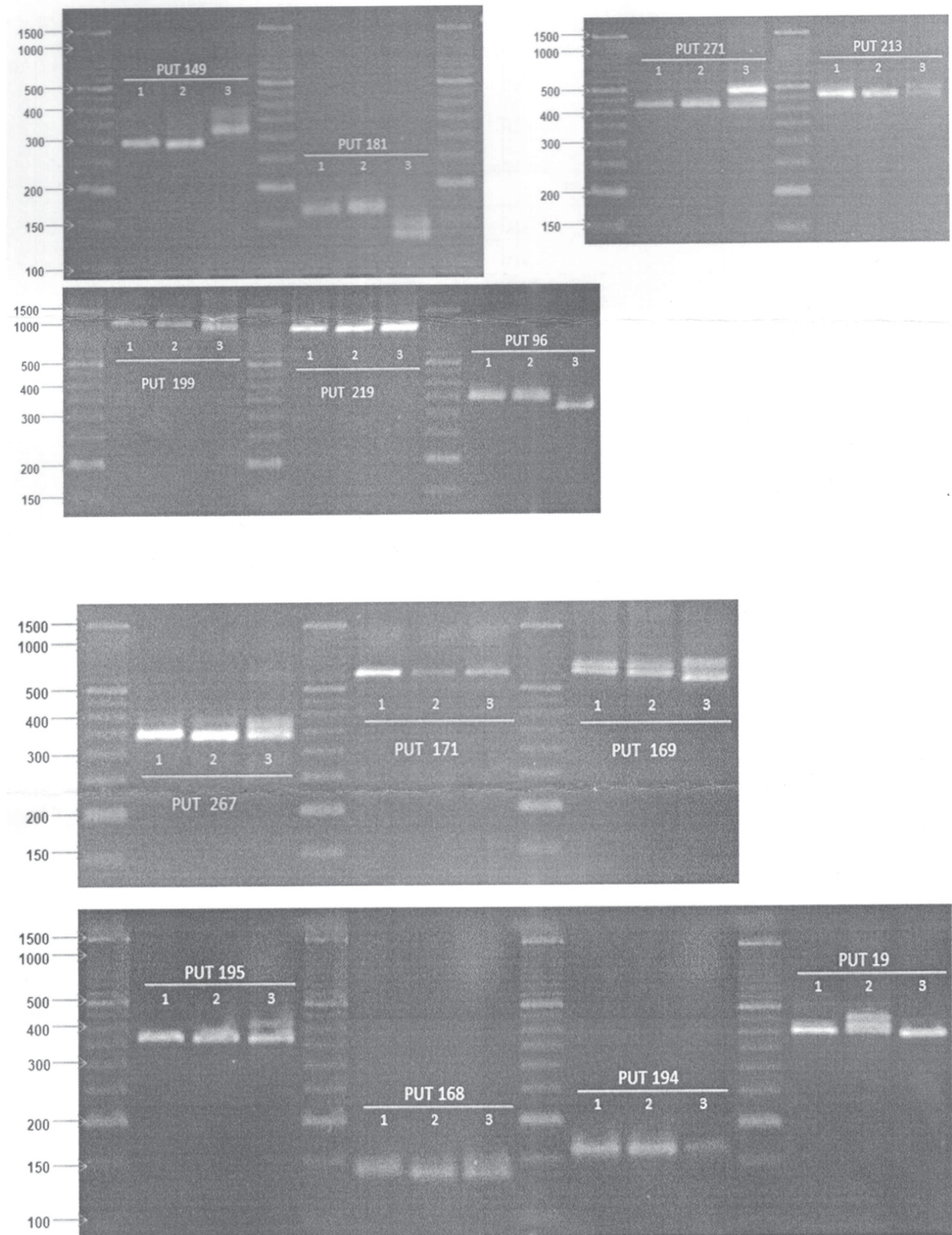


Fig. 3 : DNA profile of Raj Vijay Toria-2 (lane 3) along with controls [Basant (lane 1), PM -67 (lane 2)] generated with primer pairs of genic-SSRs (PUTs-). Molecular marker sizes are depicted in bp.

spreading in nature and primary branches with dichotomous habit. Plants height ranges from 107-124 (cm) which matures in 82-112 days (Table 3). Mature seeds are round in shape and blackish brown in colour (Fig. 2). The quantitative characters were recorded and indicated that it had higher no. of primary and secondary branches and more number of seeds/siliqua than checks (Fig.1). Similar results were reported in other study for more number of siliqua/plant, no. of seeds/siliqua and seed index had contributed to enhance seed yield significantly in the selection of genotype⁹.

This variety has wider adoptability than RVT-1. Thus, RVT-2 is suitable for rain-fed conditions of M.P. and adjoining areas of other states.

Molecular characterization of RVT-2:

DNA profile of variety Raj Vijay Toria-2 was generated with two control samples of *Brassica juncea* namely; Basant and PM-67 which indicates the different

allele sizes and polymorphic bands of the samples by using primers. Molecular marker sizes are depicted in bp. Primers PUT-19, PUT-96, PUT-149, PUT-169, PUT-181 and PUT-271 are useful in generating unique profile for discriminating **Raj Vijay Toria 2** when compared to the control samples. DNA profile of Toria (Raj Vijay Toria 2) (lane 3) along with controls [Basant (lane 1) PM-67] generated with primer pairs of genic-SSRs (PUTs-). Molecular marker sizes are depicted in bp. Primers PUT-19, PUT-96, PUT-149, PUT-169, PUT-181 and PUT-271 are useful in generating unique profile containing generated 27 bands for discriminating **Raj Vijay Toria 2** from other varieties (Fig. 3; Table 6).

Thus, the newly developed variety of toria RVT-2 had improved characters and more adoptability in U.P., M.P., Chhattisgarh, Bihar, West Bengal, Orissa, Assam and N.E. Hill State (Imphal and Tripura) which gave high seed yield and oil content which certainly increase farm income of the farmers.

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