



Economic heterosis and identification of superior hybrids for seed yield and oil content in Taramira (*Eruca sativa* Mill.) under stress condition

Mahipal Yadav*, Manohar Ram, Ashish Sheera, Mamta Ghasil, Karan Sachdeva, Arun Mirala

Department of Genetics and Plant Breeding, Sri Karan Narendra Agricultural University,
Jobner-303 329, Jaipur, Rajasthan, India

*Corresponding author- starmy97@gmail.com

<https://doi.org/10.56093/job.v17i2.12>

Received date : 19 June 2026; Revised date : 28 June 2026; Accepted date : 30 June 2026

Abstract

Taramira (*Eruca sativa* Mill.) is an important drought-tolerant oilseed crop cultivated under arid and semi-arid conditions. The present study was undertaken to assess the magnitude of economic heterosis for seed yield and its component traits using thirty F_1 hybrids developed through a line $\times$ tester mating design. The hybrids, parents and a standard check were evaluated in a randomized block design with three replications under three sowing environments during Rabi 2024–25. Significant economic heterosis was observed for all the traits studied, indicating substantial scope for the exploitation of hybrid vigour in taramira improvement. Desirable negative heterosis was recorded for days to 50% flowering, days to maturity and plant height, while positive heterosis was observed for major yield-contributing traits. The highest economic heterosis for seed yield per plant was exhibited by RTM-2202 $\times$ RTM-2111 (56.86%), followed by RTM-2270 $\times$ RTM-314 (38.31%) and RTM-2221 $\times$ RTM-1624 (36.70%). The cross RTM-2206 $\times$ RTM-314 recorded the highest positive heterosis for oil content (8.23%). Several superior hybrids also expressed significant heterosis for branching traits, siliquae per plant, siliqua density, seeds per siliqua and 1000-seed weight, contributing to enhanced seed yield. The results revealed the predominance of non-additive gene action governing yield and its associated traits and demonstrated the effectiveness of heterosis breeding in taramira. Based on overall performance and economic heterosis, RTM-2202 $\times$ RTM-2111, RTM-2270 $\times$ RTM-314, RTM-2221 $\times$ RTM-1624 and RTM-2206 $\times$ RTM-314 were identified as promising hybrids for the development of high-yielding, early maturing and oil-rich taramira cultivars.

Keywords: *Eruca sativa* Mill, economic heterosis, line $\times$ tester analysis, rocket salad, seed yield

Introduction

Taramira (*Eruca sativa* Mill.), a member of the family *Brassicaceae*, is an important winter season oilseed crop cultivated predominantly under arid and semi-arid regions of India (Noor *et al.*, 2020). Although extensively cultivated in India, taramira is believed to have originated in southern Europe and northern Africa and was subsequently introduced into the Indian subcontinent (Bailey 1949; Prakash 1980). Cytologically, it is a diploid species with a chromosome number of $2n = 22$ (Srivastava 2020). Taramira is predominantly cross-pollinated owing to the presence of sporophytic self-incompatibility (Sharma *et al.*, 1985). The crop possesses several desirable attributes, including drought tolerance, adaptability to marginal environments and resistance to powdery mildew, making it a valuable genetic resource for improvement of economically important *Brassica* species (Sastri 2003; Nitin and Sharma 2023). In different regions of India, it is known by various local names such as tara, taramira, tera, turra and sondha (Singh,

1958), while in Europe it is commonly referred to as rocket or arugula.

The seeds of taramira contain approximately 31.6–41.3 per cent oil, depending upon genotype and environmental conditions (Yadav *et al.*, 1980; Ola *et al.*, 2022; Yadav *et al.*, 2026). The oil is characterized by a high proportion of unsaturated fatty acids, particularly linolenic acid, and comparatively lower erucic acid content than many traditional rapeseed oils (Flanders and Abdulkarim, 1985; Kumar and Ohlsson, 1988). Taramira oil is commonly blended with mustard oil to enhance pungency and flavour (Kuri *et al.*, 2022). In India, its cultivation is concentrated mainly in Rajasthan, Haryana, Punjab, Gujarat, Madhya Pradesh and Uttar Pradesh. Rajasthan accounts for the largest share of area and production, with major growing districts including Jaipur, Sawai Madhopur, Sri Ganganagar, Bhilwara, Bikaner, Jalore, Nagaur and Pali. During 2023–24, taramira occupied about 1.73 lakh hectares in Rajasthan, producing 0.90 lakh tonnes with an average productivity of 519 kg ha⁻¹

(Anonymous, 2023–24).

Despite its remarkable adaptability, the productivity of taramira remains relatively low. The crop is generally cultivated under rainfed conditions on marginal and sub-marginal lands with minimal agricultural inputs. Therefore, genetic improvement of taramira through systematic breeding approaches remains a key strategy for enhancing productivity under diverse agro-climatic conditions.

Materials and Methods

The research experiment was carried out at the Instructional Farm of Sri Karan Narendra College of Agriculture, Jobner (Rajasthan). Jobner is situated at 435 meters above mean sea level on latitude 26° 5' N and 75° 20' E. It comes under agro climatic zone-III A (semi-arid eastern plain zone) having loamy sandy soils and the average rainfall of the locality is about 400 mm, which is mostly received from south-west monsoon during last week of June to end of September. The experimental material consisted of forty-four genotypes *i.e.*, ten lines, three tester genotypes, one check and thirty F₁ hybrids which were obtained through line x tester mating design, was evaluated in the randomized block design with three replications during the season *Rabi*, 2024-25. All the genotypes were evaluated under three environments created by manipulation of date of sowing namely, early (E1), normal (E2) and late (E3) environments. Each genotype was allocated two rows, each 2.0 meters long and spaced 30 cm apart. A plant-to-plant distance of 10 cm was maintained consistently across all environments. The observations on days to flowering, days to maturity, plant height (cm), primary branches per plant, secondary branches per plant, siliquae per plant, siliqua density, siliqua length (cm), seeds per siliqua, seed yield per plant, test weight (g) and oil content (%) were recorded 10 randomly selected plants except days to flowering, days to maturity which was recorded on whole plot basis. Heterosis over standard check RTM-1351 (Standard Heterosis %) was calculated as per cent increase or decrease of F₁ over standard check (Meredith and Bridge 1972) by windostat version 9.5.

Results and Discussion

The possibility of commercial exploitation of hybrid vigour depends on the magnitude of heterosis. The superiority of hybrid over better parent might be either due to dominance or epistasis or over dominance or combined effect of these. Superiority of F₁ over standard check is more useful than superiority of F₁ over better parent is determining the feasibility of commercial

exploitation of heterosis. Heterosis breeding could be a potential alternative for achieving quantum jump in production and productivity of crop plants. Commercial exploitation of heterosis has not been made in taramira for want of adequate information on extent of heterosis; therefore, it is necessary to examine magnitude of heterosis in taramira. The magnitude of heterosis particularly for seed yield is of paramount importance and if the exploitation of heterosis is practically and economically feasible it can help to reach high field levels in taramira. The extent of economic heterosis varied considerably among the thirty F₁ hybrids for all the characters studied, indicating the presence of substantial exploitable genetic variability in taramira. Economic heterosis for days to 50% flowering ranged from –5.84 to 5.84 per cent. Since earliness is a desirable attribute under arid and semi-arid environments, negative heterosis was considered beneficial. Among the hybrids, RTM-2221 × RTM-314 exhibited the highest significant negative economic heterosis (–5.84%), followed by RTM-2206 × RTM-314 (–5.18%) and RTM-2201 × RTM-1624 (–4.38%). A total of nine crosses showed significant negative heterosis, whereas four crosses exhibited significant positive heterosis for this trait. Economic heterosis for days to maturity ranged from –3.52 to 4.58 per cent. The most desirable significant negative heterosis was observed in RTM-2209 × RTM-1624 (–3.52%), followed by RTM-2208 × RTM-2111 (–3.05%) and RTM-2201 × RTM-1624 and RTM-2202 × RTM-1624 (–1.78%). Three hybrids exhibited significant negative heterosis, while seven hybrids recorded significant positive heterosis for days to maturity (Table 1). Similar results were also confirmed by Rameeh (2011), Ahsan *et al.* (2013) and Gami and Chauhan (2013).

Economic heterosis for plant height varied from –25.57 to 25.57 per cent. Reduction in plant height is often desirable owing to improved lodging resistance and efficient assimilate partitioning. The highest significant negative heterosis was recorded by RTM-2270 × RTM-2111 (–25.57%), followed by RTM-2221 × RTM-2111 (–10.05%) and RTM-2206 × RTM-314 (–9.06%). Two crosses showed significant negative heterosis, whereas only one cross exhibited significant positive heterosis for plant height. For primary branches per plant, economic heterosis ranged from –15.88 to 44.10 per cent. The highest significant positive heterosis was exhibited by RTM-2204 × RTM-1624 (44.10%), followed by RTM-2221 × RTM-1624 (41.72%) and RTM-2270 × RTM-2111 (37.42%). Ten hybrids showed significant positive heterosis, while one hybrid expressed significant negative heterosis. Similarly, economic heterosis for secondary branches per plant

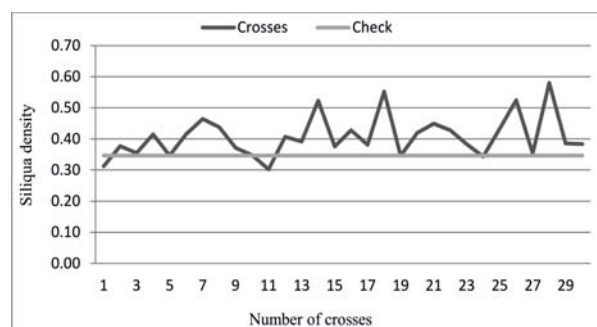


Fig. 1 Crosses vs. Check performance for siliqua density under stress condition

ranged from -17.94 to 35.89 per cent. The hybrids RTM-2270 $\times$ RTM-314 (35.89%), RTM-2204 $\times$ RTM-1624 (30.59%) and RTM-2221 $\times$ RTM-1624 (29.12%) exhibited the highest significant positive heterosis. Eight hybrids showed significant positive heterosis and one hybrid exhibited significant negative heterosis. The magnitude of economic heterosis for siliquae per plant ranged from -15.88 to 62.63 per cent. The highest significant positive heterosis was observed in RTM-2204 $\times$ RTM-1624 (62.63%), followed by RTM-2221 $\times$ RTM-1624 (55.26%) and RTM-2223 $\times$ RTM-1624 (47.76%). Eleven hybrids exhibited significant positive heterosis, whereas one hybrid showed significant negative heterosis. Economic heterosis for siliqua density ranged from -16.98 to 67.31 per cent. The hybrids RTM-2270 $\times$ RTM-1624 (67.31%), RTM-2221 $\times$ RTM-1624 (55.26%) and RTM-2204 $\times$ RTM-1624 (33.65%) recorded the highest significant positive heterosis. Ten crosses exhibited significant positive heterosis, while two crosses showed significant negative heterosis (Table 1) (Fig 1). Earlier similar results were reported by Patel *et al.* (2015), Gautam and Chauhan (2016), Afrose *et al.* (2025), Alpaslan and Sincik (2025) and Singh *et al.* (2025)

For siliqua length, the highest significant positive economic heterosis was recorded by RTM-2208 $\times$ RTM-314 (23.43%), followed by RTM-2206 $\times$ RTM-2111 (17.17%) and RTM-2201 $\times$ RTM-314 (15.33%). Two crosses exhibited significant positive heterosis, whereas three crosses showed significant negative heterosis (Fig 2). Economic heterosis for seeds per siliqua was highest in RTM-2206 $\times$ RTM-314 (15.03%), followed by RTM-2208 $\times$ RTM-2111 (11.17%) and RTM-2270 $\times$ RTM-2111 (9.45%). Four hybrids expressed significant positive heterosis, while one hybrid showed significant negative heterosis (Fig 3). Economic heterosis for 1000-seed weight ranged widely among the hybrids. The highest significant positive heterosis was observed in RTM-2223 $\times$ RTM-1624 (20.94%), followed by RTM-2208 $\times$ RTM-314 (18.76%) and RTM-2209 $\times$ RTM-1624 (17.65%). Eight hybrids

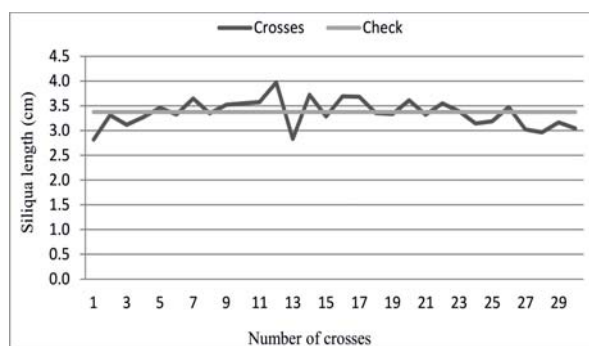


Fig. 2 Crosses vs. Check performance for siliqua length (cm) under stress condition

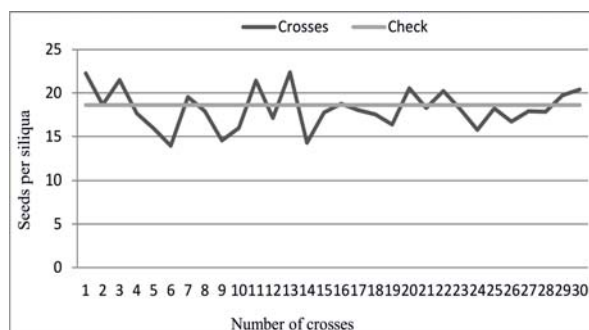


Fig. 3 Crosses vs. Check performance for seeds per siliqua under stress condition

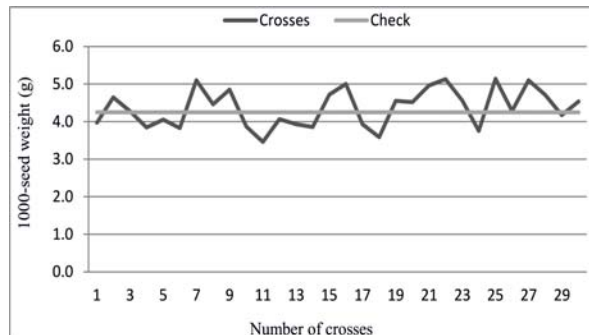


Fig. 4 Crosses vs. Check performance for 1000-seed weight (g) under stress condition

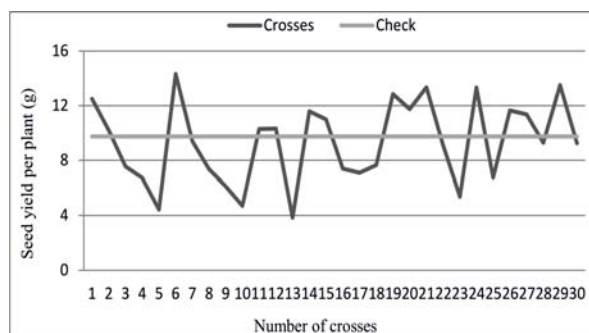


Fig. 5 Crosses vs. Check performance for seed yield per plant (g) under stress condition

Table 1: Economic heterosis for seed yield and yield-contributing traits in Taramira (*Eruca sativa* Mill.) under stress conditions

Crosses	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches per plant	Secondary branches per plant	Siliquae per plant	Silique density	Silique length (cm)	Seeds per silique	1000-seed weight (g)	Seed yield per plant (g)	Oil content (%)
RTM-2201 X RTM-1624	-4.38 *	-1.78	-20.50 **	42.33 **	12.35	-1.10	-10.58	-16.49 **	19.50 **	-6.59 **	28.06 **	2.55
RTM-2201 X RTM-314	-2.19	-0.25	-1.55	2.45	32.35 **	54.74 **	8.65	-1.97	0.00	9.33 **	4.51	1.65
RTM-2201 X RTM-2111	-4.38 *	-1.02	-12.94 *	9.82	-0.29	8.12	2.88	-7.80	15.38 **	0.63	-22.66 *	2.23
RTM-2202 X RTM-1624	-1.46	-1.78	1.64	4.29	7.94	15.38 *	19.23 *	-3.16	-5.19	-9.49 **	-31.20 **	5.30 **
RTM-2202 X RTM-314	9.49 **	5.34 **	-2.08	42.33 **	-25.88 **	0.20	0.96	2.47	-14.67 *	-4.71	-54.61 **	6.37 **
RTM-2202 X RTM-2111	-5.84 **	-3.05 **	-5.11	10.43	-7.94	-3.99	20.19 *	-1.58	-25.22 **	-9.88 **	46.86 **	3.29 *
RTM-2204 X RTM-1624	-3.65	-3.56 **	4.28	41.10 **	30.59 **	62.63 **	33.65 **	8.00	4.83	19.92 **	-3.69	4.95 **
RTM-2204 X RTM-314	0.73	2.29 *	-3.39	7.36	19.12 *	38.44 **	26.92 **	-0.89	-3.94	5.02 *	-24.61 **	2.24
RTM-2204 X RTM-2111	5.11 *	1.27	-12.24 *	57.67 **	-17.94	3.09	7.69	4.24	-22.00 **	14.20 **	-37.22 **	3.39 *
RTM-2206 X RTM-1624	2.92	0.51	2.12	0.61	-7.94	-1.13	0.00	5.13	-14.31 *	-8.94 **	-51.81 **	2.18
RTM-2206 X RTM-314	-5.11 *	0.00	-9.06	7.36	7.65	-3.38	-12.50	5.82	15.03 *	-18.51 **	5.50	2.83 *
RTM-2206 X RTM-2111	0.73	0.76	-5.63	28.22 **	39.12 **	44.83 **	17.31	17.67 **	-8.05	-4.39	5.74	5.34 **
RTM-2208 X RTM-1624	0.73	3.05 **	-3.14	7.98	20.00 *	19.22 *	12.50	-16.19 **	20.21 **	-7.53 **	-60.59 **	2.45
RTM-2208 X RTM-314	5.11 *	-0.76	-0.79	-0.61	-15.88	-2.89	50.96 **	10.17	-23.43 **	-9.25 **	18.76 *	1.37
RTM-2208 X RTM-2111	-1.46	-3.05 **	-8.46	17.18	26.76 **	27.95 **	8.65	-2.76	-4.65	11.06 **	12.61	-1.87
RTM-2209 X RTM-1624	-8.03 **	-3.82 **	0.62	36.20 **	25.00 **	46.50 **	23.08 *	9.28	0.72	17.65 **	-24.27 **	4.76 **
RTM-2209 X RTM-314	2.92	0.76	-3.44	11.66	20.88 *	39.48 **	9.62	8.98	-3.22	-7.45 **	-27.44 **	3.34 *
RTM-2209 X RTM-2111	-3.65	0.76	2.51	-2.45	4.41	8.82	58.65 **	-0.79	-5.90	-15.69 **	-21.67 *	2.26
RTM-2211 X RTM-1624	-5.11 *	0.00	-0.03	14.11	20.88 *	0.06	0.00	-1.28	-12.16 *	7.14 **	31.65 **	2.41
RTM-2211 X RTM-314	5.11 *	-4.58 **	6.65	41.10 **	32.35 **	61.71 **	21.15 *	6.91	10.20	6.27 *	20.37 *	6.27 **
RTM-2211 X RTM-2111	-8.03 **	-3.31 **	2.60	13.50	35.29 **	55.98 **	29.81 **	-1.68	-1.97	16.78 **	36.77 **	1.31
RTM-2221 X RTM-1624	0.00	2.04 *	1.87	41.72 **	29.12 **	55.26 **	23.08 *	5.13	8.59	20.63 **	-6.80	2.77
RTM-2221 X RTM-314	-5.84 **	0.25	4.12	21.47 *	17.94	50.26 **	10.58	0.39	-2.68	7.45 **	-44.98 **	4.47 **
RTM-2221 X RTM-2111	-6.57 **	4.58 **	-10.05	-4.91	-12.35	-2.86	-0.96	-6.91	-15.38 **	-11.76 **	36.53 **	-1.19
RTM-2223 X RTM-1624	5.11 *	2.04 *	-3.10	4.29	9.12	41.76 **	24.04 *	-5.63	-2.15	20.94 **	-30.90 **	4.58 **
RTM-2223 X RTM-314	0.73	5.34 **	-8.89	58.28 **	29.71 **	34.34 **	51.92 **	2.86	-10.38	0.71	19.28 *	2.28
RTM-2223 X RTM-2111	-3.65	-3.82 **	-10.79	2.45	11.47	26.36 **	1.92	-10.46	-3.94	20.00 **	16.37	3.85 **
RTM-2270 X RTM-1624	-1.46	3.82 **	-1.11	4.29	22.06 *	36.94 **	67.31 **	-12.24 *	-4.29	10.82 **	-4.89	3.70 *
RTM-2270 X RTM-314	-3.65	1.53	0.94	-3.68	35.88 **	18.12 *	11.54	-6.32	5.90	-1.88	38.31 **	-1.34
RTM-2270 X RTM-2111	0.73	4.58 **	-23.57 **	37.42 **	32.94 **	41.18 **	10.58	-9.87	9.48	6.75 **	-5.16	3.70 *

recorded significant positive heterosis and two hybrids exhibited significant negative heterosis (Fig 4). Seed yield per plant, the most important economic trait, showed heterosis ranging from -31.20 to 38.41 per cent. The highest significant positive economic heterosis was observed in RTM-2270 × RTM-314 (38.41%), followed by RTM-2223 × RTM-1624 (30.90%) and RTM-2204 × RTM-1624 (15.52%). Ten hybrids exhibited significant positive heterosis, while four hybrids showed significant negative heterosis (Table 1) (Fig 5). Positive heterosis for seed yield per plant was reported earlier by Rameeh *et al.* (2011), Yadava *et al.* (2012), Gami and Chauhan (2013), Rai *et al.* (2017), Aggarwal *et al.* (2019), Kapadia *et al.* (2020), Prakash *et al.* (2023), Afrose *et al.* (2025) and Alpaslan and Sincik (2025).

Economic heterosis for oil content ranged from -4.77 to 8.23 per cent. The highest significant positive heterosis was recorded by RTM-2206 × RTM-314 (8.23%), followed by RTM-2204 × RTM-1624 (4.95%) and RTM-2209 × RTM-1624 (4.76%). Eight hybrids expressed significant positive heterosis and two hybrids showed significant negative heterosis (Table 1). For yield contributing traits earlier similar findings were reported by Rameeh (2011), Ahsan *et al.* (2013), Gami and Chauhan (2013), Meena *et al.* (2014), Meena *et al.* (2015), Patel *et al.* (2015), Gautam and Chauhan (2016), Patel *et al.* (2016), Rai *et al.* (2017), Singh *et al.* (2017), Priyamedha *et al.* (2018), Singh *et al.* (2018), Aggarwal *et al.* (2019), Kaur *et al.* (2019), Mandal *et al.* (2023), Afrose *et al.* (2025), Alpaslan and Sincik (2025) and Singh *et al.* (2025).

Overall, the results clearly demonstrate the potential of heterosis breeding in taramira. Among the hybrids evaluated, RTM-2270 × RTM-314, RTM-2223 × RTM-1624, RTM-2204 × RTM-1624 and RTM-2206 × RTM-314 emerged as the most promising combinations due to their superior economic heterosis for seed yield and associated component traits. These hybrids warrant further evaluation across locations and seasons to assess the stability of their performance and their suitability for utilization in future breeding programmes. Based on seed yield and attributing traits the best performing hybrids emerged as RTM- 2202 X RTM- 2111, RTM- 2270 X RTM- 314, RTM- 2211 X RTM- 2111, RTM- 2211 X RTM- 1624 and RTM- 2201 X RTM- 1624, which marked the highest significant economic heterosis for yield as well as for other characters also (Table 2). The figures 1 to figure 5 represent the performance of hybrids and check RTM-1351 under stress condition for yield contributing characters which revealed that the many crosses showed increased performance over the check which can be exploited by the heterosis breeding for future enhancement in taramira.

Table 2: Top five promising crosses identified for superior yield and components traits under environmental stress

Crosses	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches per plant	Secondary branches per plant	Siliquae per plant	Siliqua density	Siliqua length (cm)	Seeds per siliqua	1000-seed weight (g)	Seed yield per plant (g)	Oil content (%)
RTM- 2202 X RTM- 2111	-5.84 **	-3.05 **	-5.11	10.43	-7.94	-3.99	20.19 *	-1.58	-25.22 **	-9.88 **	46.86 **	3.29 *
RTM- 2270 X RTM- 314	-3.65	1.53	0.94	-3.68	35.88 **	18.12 *	11.54	-6.32	5.90	-1.88	38.31 **	-1.34
RTM- 2211 X RTM- 2111	-8.03 **	-3.31 **	2.60	13.50	35.29 **	55.98 **	29.81 **	-1.68	-1.97	16.78 **	36.77 **	1.31
RTM- 2211 X RTM- 1624	-5.11 *	0.00	-0.03	14.11	20.88 *	0.06	0.00	-1.28	-12.16 *	7.14 **	31.65 **	2.41
RTM- 2201 X RTM- 1624	-4.38 *	-1.78	-20.50 **	42.33 **	12.35	-1.10	-10.58	-16.49 **	19.50 **	-6.59 **	28.06 **	2.55

Conclusion

Economic heterosis analysis of thirty F₁ hybrids revealed substantial hybrid vigour for seed yield and its component traits in taramira. Significant desirable negative heterosis was observed for days to 50% flowering, days to maturity and plant height, indicating the possibility of developing early and moderately dwarf genotypes suitable for moisture-stressed environments. The crosses RTM-2221 × RTM-314, RTM-2221 × RTM-314 and RTM-2270 × RTM-2111 were identified as the most promising combinations for earliness and reduced plant stature. Marked positive economic heterosis was recorded for branching traits, siliquae per plant, silique density, seeds per silique, 1000-seed weight, seed yield and oil content. The crosses RTM-2202 × RTM-2111, RTM-2270 × RTM-314 and RTM-2221 × RTM-1624 exhibited the highest economic heterosis for seed yield per plant, while RTM-2206 × RTM-314 showed the highest heterosis for oil content. The superior performance of these hybrids was associated with favourable heterotic responses for several yield-contributing characters, demonstrating the cumulative influence of component traits on seed yield expression. The results indicate a predominant role of non-additive gene action in the inheritance of yield and related traits and highlight the potential of heterosis breeding for genetic improvement of taramira. Based on overall economic heterosis, seed yield performance and associated component traits, RTM-2202 × RTM-2111, RTM-2270 × RTM-314, RTM-2221 × RTM-1624 and RTM-2206 × RTM-314 emerged as the most promising hybrids. These crosses may be utilized in future breeding programmes aimed at developing high-yielding, early maturing and oil-rich taramira cultivars after validation across environments and generations.

References

- Afroze R, Tabassum T, Mohosina F, Meem HZ, Noor MMA and Mehedi MNH. 2026. Decoding gene activity and heterosis: Line × tester analysis for yield traits in rapeseed (*Brassica napus* L.). *Agril Rev* **47**: 111-121.
- Aggarwal M, Punia MS and Monika. 2019. Correlation and heterosis studies in various populations of Indian mustard [*Brassica juncea* (L.) Czern and Coss]. *Int J Curr Microbiol Applied Sci* **8**: 2122-2130.
- Ahsan MZ, Khan FA, Kang SA and Rasheed K. 2013. Combining ability and heterosis analysis for seed yield and yield components in *Brassica napus* L. *J Biol Agric Healthcare* **3**: 2224-3208.
- Alpaslan CD and Sincik M. 2025. Determination of combining ability in Ethiopian mustard (*Brassica carinata*) parents according to line × tester analysis. *Tur J Field Crops* **30**: 1-9.
- Anonymous. 2023-24. Rajasthan Agricultural Statistics at a Glance. Department of Agriculture, Pant Krishi Bhawan, Jaipur, Rajasthan.
- Flanders A and Abdulkarim SM. 1985. The composition of seed and seed oils of Taramira (*Eruca sativa*). *J Am Oil Chemists Soc* **62**: 1134-1135.
- Gami RA and Chauhan RM. 2013. Heterosis and combining ability analysis for seed yield and its attributes in Indian mustard [*Brassica juncea* (L.) Czern & Coss.]. *Ind J Agril Res* **47**: 535-539.
- Gautam SC and Chauhan MP. 2016. Combining ability of plant height and yield components in Indian mustard [*Brassica juncea* (L.) Czern and Coss] under salt affected soil using line × tester analysis. *J Agri Search* **3**: 93-100.
- Kapadia VN, Sasidharan N and Kalola AD. 2020. Estimation of heterosis for yield related traits for single cross hybrids of *Brassica* species. *J Pharmacognosy Phytochem* **9**: 1766-1773.
- Kaur S, Kumar R, Kaur R, Singh I, Singh H and Kumar V. 2019. Heterosis and combining ability analysis in Indian mustard [*Brassica juncea* (L.) Czern and Coss]. *J Oilseed Brassica* **10**: 1-9.
- Kumar PR and Ohlsson I. 1988. The International Society for Fat Research (ISF) and the Japan Oil Chemists' Society, *Joint world Congress*, September 26-30, Tokyo, Japan.
- Kuri J, Yadav JP, Jakhar M and Kumar J. 2022. The knowledge level of farmers about recommended cultivation practices of Taramira. *The Pharma Innov J* **11**: 408-411.
- Mandal KN, Subba V, Dasgupta T and Kundagrami S. 2023. Combining ability and heterosis for seed yield and yield components in Indian mustard [*Brassica juncea* (L.) Czern and Coss]. *Agric Rev* **44**: 100-106.
- Meredith WR and Bridge RR. 1972. Heterosis and gene action in Cotton *Gossypium hirsutum*. *Crop Sci* **12**: 304-310.
- Nitin CS and Sharma PK. 2023. Influence of foliar spray of cow urine and vermi-wash on growth and yield attributes of taramira (*Eruca sativa* Mill.). *The Pharma Innov J* **12**: 1532-1535.
- Noor RS, Wang Z, Umair M, Ameen M, Misaal MA and Sun Y. 2020. Long-term application effects of organic and chemical fertilizers on soil health and productivity of taramira (*Eruca sativa* Mill.) under rainfed conditions. *J Animal Plant Sci* **30**: 970-987.
- Ola MP, Jakhar ML, Gothwal DK, Ahmad S and Ram M.

2021. Genotypic x environment interaction and stability analysis for yield and yield attributes in taramira (*Eruca sativa* Mill.). *Int J Environ Climate Change* **11**: 1-11.
- Patel AP, Prajapati KP, Patel PJ, Shah SK and Patel PS. 2015. Genetic studies of yield and quality traits in Indian mustard [*Brassica juncea* (L.) Czern and Coss]. *J Oilseed Brassica* **6**: 289-295.
- Prakash D, Sinha B and Srivastava K. 2023. Heterosis and combining ability studies under artificial epiphytotic condition for yield and its related traits in Indian mustard. *J Oilseeds Res* **40**: 28-32.
- Prakash S. 1980. Cruciferous Oilseeds in India. In *brassica crops and wild allies*. *Japan Scientific Soc Press*, 155-166.
- Priyamedha AK, Haider ZA, Bhagirath R, Singh VV and Dhiraj S. 2018. Estimation of combining ability and heterosis for yield and yield attributing traits in Indian mustard [*Brassica juncea* (L.) Czern and Coss]. *Ind J Agric Sci* **88**: 546-552.
- Rai SK, Sandhu R, Jat L, Kumar A, Kiran U, Mukhtar S, Kohli S and Rai GK. 2017. Study of heterosis and combining ability for yield and its component traits in *Brassica juncea* L. *Int J Curr Microbiol Applied Sci* **6**: 2570-2579.
- Rameeh V. 2011. Line x tester analysis for seed yield and yield components in spring and winter type varieties of oil seed rape. *J Cereals Oilseeds* **2**: 66-70.
- Sastry EVD. 2003. Taramira (*Eruca sativa*) and its improvement. *Agric Revi* **24**: 235-249.
- Sharma N, Bajaj M and Shivanna KR. 1985. Over-coming self-incompatibility through the use of lectins and sugars in *petunia* and *Eruca*. *Annals Bot* **55**: 139-141.
- Singh AK, Mall AK and Singh PK. 2018. Stability factor and heterosis for yield and yield determinants over environments in Indian rapeseed, (*Brassica rapa* var. yellow sarson). *J Applied Natural Sci* **10**: 70-76.
- Singh D. 1958. Rapeseed and mustard, Indian Central Oilseed committee. Hyderabad, pp 30-35.
- Singh KH, Singh L, Singh G, Ram B, Rai PK and Singh VV. 2025. Estimation of heterosis and the ability to combine yield attributes and seed yield in Indian mustard [*Brassica juncea* (L.) Czern and Coss]. *Ind J Agric Sci* **95**: 857-862.
- Singh M, Singh SK, Chand P, Kerkhi SA and Kumar N. 2017. Heterosis for seed yield and its components in Indian mustard [*Brassica juncea* (L.) Czern and Coss]. *J Pharmacognosy Phytochem* **6**: 755-759.
- Srivastava KSJ. 2020. Diseases of taramira (*Eruca sativa* Mill.) and their management: Indian perspective. *Diseases Field crops diagnosis manage* **2**: 307-319.
- Yadav M, Ram M, Gupta D, Shivran AC, Mittal G, Sharma MK. 2026. Line x tester analysis reveals predominance of nonadditive gene action for yield improvement in taramira (*Eruca sativa* mill.). *Plant Arch* **26**: 2557-2563.
- Yadav TP, Kumar P and Yadav AK. 1980. Stability analysis for oil content and yield components in groundnut (*Arachis hypogea* L.). *Haryana Agric Uni J Res* **10**: 560-563.
- Yadava DK, Singh N, Vasudev S, Singh R, Singh S, Giri SC, Dwivedi VK and Prabhu KV. 2012. Combining ability and heterobeltiosis for yield and yield-contributing traits in Indian mustard. *Ind J Agric Sci* **82**: 563-567.