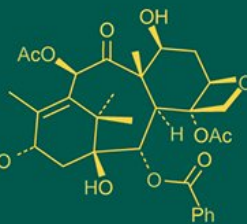


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Relative susceptibility of promising lines of Gudmar (*Gymnema sylvestre* R. Br.) against Oleander aphid, *Aphis nerii* Fonscolombe

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Abstract

Gudmar, *Gymnema sylvestre* R. Br. (Family: Apocynaceae), is an important medicinal crop valued for its diverse therapeutic properties, particularly its anti-diabetic potential. The oleander aphid, *Aphis nerii* Fonscolombe (Hemiptera: Aphididae), is an important sucking pest causing considerable damage to Gudmar, especially in winter. Thus, the present investigation was undertaken to assess the relative susceptibility of five promising lines of Gudmar to *A. nerii* under field conditions during Rabi, 2024-25 and Rabi, 2025-26. The pooled mean aphid index of the promising lines ranged from 1.33 to 2.64 per plant. Among the evaluated lines, TNAU-Local recorded the lowest aphid index (1.33) and was categorized as highly resistant, while TNGSy-28 (1.91) was categorized as resistant. TNGSy-14 (2.31) and TNGSy-20 (2.18) were categorized as susceptible, whereas TNGSy-16 recorded the highest aphid index (2.64) and was categorized as highly susceptible. The considerable variation in susceptibility observed among the promising lines indicates the presence of differential host plant response to *A. nerii*. The relatively less susceptible lines, particularly TNAU-Local and TNGSy-28, may serve as valuable genetic resources for future screening and breeding programmes aimed at developing aphid-resistant Gudmar cultivars. The identified resistant lines may also contribute to reducing dependence on insecticides and can be effectively integrated with other components of integrated pest management for sustainable management of *A. nerii* in Gudmar.

Keywords: Gudmar, aphid, susceptible, resistant, lines, management

Introduction

Gymnema sylvestre R. Br. is one of the important medicinal crops. It is commonly known as Gudmar or Madhunashini for its distinct property as a sugar destroyer. This herb has been used in India for managing diabetes since ancient times (Tiwari *et al.*, 2014) [22]. Belonging to the family Apocynaceae, it is a perennial woody climber native to southern and central India and Sri Lanka. Its leaves contain a mixture of bioactive compounds, viz., triterpenes and saponins belonging to oleanane and dammarane classes. Among them, gymnemic acid is an effective substance (Shah, 2010) [15] to be used widely as anti-diabetic {Type II diabetes (Shivakumara *et al.*, 2022) [18] i.e. Diabetes mellitus, which is the fourth leading cause of death from non-communicable diseases worldwide, affecting one in every eleven adults (Joshi and Parikh, 2007; Kumar *et al.*, 2013; International Diabetes Federation, 2021) [4, 5, 8]}, anti-inflammatory (Shaw *et al.*, 2010) [16], anti-sweetener (Kurihara, 1992) [9], anti-hypercholesterolemic (Bishayee and Chatterjee, 1994) [2], anti-microbial (Satdive *et al.*, 2003) [14] and ethno-veterinary medicine (Kalidas *et al.*, 2009) [6]. Its predominantly wild growth, coupled with the lack of standardized agro-techniques, renders the species vulnerable to multiple biotic and abiotic stresses in Madhya Pradesh (Srivastava *et al.*, 1999) [20]. Among the various insect pests infesting Gudmar, the oleander aphid, *Aphis nerii* Fonscolombe (Hemiptera: Aphididae), is the major pest that appears in the winter season and is known to cause significant damage to crop yield (Andhale *et al.*, 2024) [1]. It is a common sucking pest of several medicinal and ornamental plants belonging to the Apocynaceae and Asclepiadaceae families. Both nymphs and adults feed on the crop and cause direct damage to the plant, along with the secretion of substantial amounts of honeydew, which provides a favorable substrate for the development of sooty mold on various plant parts, ultimately interfering with photosynthetic activity and thereby adversely affecting overall plant growth

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and productivity (Shivakumara *et al.*, 2022) ^[18]. They preferentially infest the young and succulent plant parts, resulting in host weakening and leaf curling. The extent of damage largely depends on the aphid population density on the plant. Under severe infestation, continuous sap-sucking by large aphid populations may lead to the death of the entire vine (Rabeea, 2021) ^[12]. It adversely affects the quality and quantity of the economically important plant parts, particularly foliage and fruits, leading to substantial economic losses.

The timely implementation of appropriate management strategies is crucial to prevent extensive crop damage (Mansour *et al.*, 2018) ^[10]. The fundamental challenge is that traditional pest control relies heavily on synthetic chemical pesticides, and applying these chemicals to medicinal plants compromises their therapeutic efficacy and may introduce dangerous toxic residues into healthcare products (Kumari and Srinivas, 2018) ^[7]. Moreover, the application of pesticides poses a significant negative impact on the environment and non-target organisms, including humans, bees, and beneficial insects, and may also lead to the development of resistance in aphids, which further complicates aphid control (Shivakumara *et al.*, 2022; Siddiqui *et al.*, 2023) ^[18, 19]. Hence, integrated pest management based on sound ecological principles is essential for monitoring and management of aphid populations below economic threshold levels while preserving the medicinal purity of Gudmar.

A sustainable pest control method is the development and cultivation of genetically resistant plant varieties, which offer a practical and long-term solution by naturally suppressing the pest population with minimal disturbance to the crop ecosystem, and reducing the need for harmful pesticides. Despite the increasing significance of pests damaging Gudmar in India, there is a lack of comprehensive information on resistant genotypes (Shivakumara *et al.*, 2024) ^[17]. Keeping the above facts in view, the present investigation was taken up to identify the promising lines of Gudmar that are resistant or less susceptible to Oleander aphid, *Aphis nerii*. To the best of our knowledge, the present study is the first attempt in India and across the globe and can be considered one of the most effective and economical approaches for aphid management, and can also be effectively integrated with other control measures to reduce pest damage.

2. Materials and Methods

2.1. Site and location of experiment: The experiment was carried out at the field of All India Coordinated Research Project (Medicinal, Aromatic Plants and Betel vine) of Department of Plant Physiology, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during *Rabi*, 2024-25 and *Rabi*, 2025-26. Geographically, Jabalpur is located between 22°49' and 24°8' North latitude, and 78°21' and 80°58' East longitude, and at an altitude of 411.78 metres or 1350.18 feet above the mean sea level with a total area of 5198 km² in the central-eastern region of Madhya Pradesh, India (Chacko, 2025) ^[3].

2.2. Climatic and weather conditions of location: The climate of the region is typically semi-humid and sub-tropical. The average annual rainfall is nearly 1000-1500 mm, which is mostly received between the middle of June and early October. Temperature extremes range from 5-6 °C

in December and January to 46 °C in May and June, with occasional light rain during the winter. The relative humidity remains low (20 to 35%) during *Zaid* and moderate (50 to 60%) during *Rabi*, while it attains maximum values of 80 to 95% during *Kharif* (Chacko, 2025) ^[3].

2.3. Layout and design of Experiment: The experiment was laid out in a simple randomized block design (RBD) with five promising lines of Gudmar (*i.e.* TNGSy-14, TNGSy-16, TNGSy-20, TNGSy-28 and TNAU-Local) as treatments, each replicated four times in the plot of size 3.0 m x 1.5 m with 1.0 m x 1.5 m spacing (row x plant) during *Rabi*, 2024-25 and *Rabi*, 2025-26.

2.4. Observations: Observations on aphid populations were recorded on one randomly selected plant from each plot belonging to each replication once during a standard meteorological week soon after their appearance. The aphid population was estimated by adopting an aphid index (zero to five) throughout the observation (Patel, 1980) ^[11]. For assigning the aphid index, three branches were randomly selected from each selected plant, and aphids were counted from the 10 cm terminal twig of each branch (Regar *et al.*, 2022) ^[13]. The crop was kept unprotected for this study.

Aphid index

0 = Plant free from aphids.

1 = Aphid present but colonies not built up. No injury due to pest appearance on the plant.

2 = Small colonies of aphids present on leaves of the plant. Such leaves exhibit slight curling due to aphid feeding.

3 = Large colonies of aphids present on leaves and other parts. Damage symptoms visible due to aphid feeding.

4 = Most of the leaves covered with aphid colonies. Counts not possible, and the plant shows more damage symptoms due to aphid feeding.

5 = Plant completely covered with aphid colonies. Plant growth hindered due to pest feeding.

The average aphid index was worked out by using the following equation:

$$\text{Average aphid index} = \frac{0N+1N+2N+3N+4N+5N}{\text{The total number of plants observed}}$$

where,

0, 1, 2, 3, 4, 5 are the aphid index, and

N = Number of plants showing respective aphid index.

2.5. Interpretation of data: The data obtained on aphid index from experimental field were transformed into square root transformed values ($\sqrt{x+0.5}$) and subjected to analysis of variance (ANOVA). The significance among each treatment was then tested using Duncan's Multiple Range Test (DMRT) as proposed by Thumar *et al.* (2020) ^[21]. The promising lines of Gudmar were categorized on the basis of the scale given in Table 1.

Table 1: Scale used for categorizing promising lines of Gudmar

Categories of resistance	Scales for resistance
Highly resistant (HR)	$X_i < (X - sd)$
Resistant (R)	$(X - sd) < X_i < X$
Susceptible (S)	$X < X_i < (X + sd)$
Highly susceptible (HS)	$(X + sd) < X_i < (X + 2sd)$

where,
 X_i = Mean value of infestation of individual lines
 X = Mean value of infestation of all lines, and
 sd = Standard deviation

3. Results

During *Rabi*, 2024-25 and *Rabi*, 2025-26, a total of five promising lines of Gudmar, *Gymnema sylvestre* R. Br., were tested under field conditions to determine their relative susceptibility to the oleander aphid, *Aphis nerii* Fonscolombe (Fig. 1). The weekly observations on the aphid populations were recorded soon after their appearance. None of the promising lines of Gudmar under study was found completely free of aphid infestation. An aphid index ranging from zero to five was employed to assess the aphid population, and the data thus obtained are presented in Table 2 and Fig. 2. The relative susceptibility of each promising line to aphid infestation was determined based on the corresponding aphid index values.

The mean aphid index during *Rabi*, 2024-25 ranged from 1.27 to 2.49 per plant on different promising lines of Gudmar (Table 2 and Fig. 2). The minimum aphid infestation (1.27 aphid index/ plant) was recorded on TNAU-Local, and was found to be significantly superior to all other lines. It was followed by TNGSy-28 (1.77 aphid index/ plant). The maximum infestation was recorded on TNGSy-16 (2.49 aphid index/ plant), and this value was found to be significantly higher than that of all other lines. It was followed by TNGSy-14 (2.17 aphid index/ plant) and TNGSy-20 (2.04 aphid index/ plant), which differed significantly from each other.

The mean aphid index during *Rabi*, 2025-26 ranged from 1.39 to 2.79 per plant on different promising lines of Gudmar (Table 2 and Fig. 2). The minimum aphid infestation (1.39 aphid index/ plant) was recorded on TNAU-Local, and was found to be significantly superior to all other lines. It was followed by TNGSy-28 (2.04 aphid index/ plant). The maximum infestation was recorded on TNGSy-16 (2.79 aphid index/ plant), and this value was found to be significantly higher than that of all other lines. It was followed by TNGSy-14 (2.45 aphid index/ plant) and TNGSy-20 (2.32 aphid index/ plant), which were statistically at par with each other.

The pooled mean aphid index of both seasons (*Rabi*, 2024-25 and *Rabi*, 2025-26) varied from 1.33 to 2.64 aphid index

per plant (Table 2 and Fig. 2). Among the evaluated promising lines of Gudmar, TNAU-Local recorded the lowest aphid index (1.33 aphid index/ plant) and was found to be significantly superior to all other lines. It was followed by TNGSy-28, which recorded an aphid index of 1.91 per plant. In contrast, TNGSy-16 recorded the highest aphid index (2.64 aphid index/ plant), and this value was found to be significantly higher than that of all other lines, indicating greater susceptibility to aphid incidence. It was followed by TNGSy-14 (2.31 aphid index/ plant) and TNGSy-20 (2.18 aphid index/ plant), which were statistically at par with each other. Based on the pooled mean aphid index of both the seasons, the order of susceptibility of different promising lines of Gudmar to aphid incidence was found as: TNGSy-16 > TNGSy-14 > TNGSy-20 > TNGSy-28 > TNAU-Local. The categorization of different promising lines of Gudmar are summarized in Table 3., viz., highly resistant (HR), resistant (R), susceptible (S), and highly susceptible (HS) based on the aphid index by comparing the mean value of infestation of individual lines (X_i) with the mean value of infestation of all lines ($X = 2.07$), and the standard deviation ($sd = 0.49$). Taking the above categorization into consideration, the line TNAU-Local ($X_i = 1.33$) was found highly resistant (HR), and TNGSy-28 ($X_i = 1.91$) was categorized as resistant (R). However, the lines TNGSy-14 ($X_i = 2.31$) and TNGSy-20 ($X_i = 2.18$) were grouped as susceptible (S), and TNGSy-16 ($X_i = 2.64$) was categorized as highly susceptible (HS).



Fig 1: Severe infestation of *Aphis nerii* on *Gymnema sylvestre*

Table 2: Relative susceptibility of promising lines of Gudmar against Oleander aphid, *Aphis nerii* Fonscolombe

S. No.	Promising lines of Gudmar	Mean aphid index per plant		
		Rabi, 2024-25	Rabi, 2025-26	Pooled (Rabi, 2024-25 and 2025-26)
1.	TNGSy-14	2.17 (1.63) ^b	2.45 (1.71) ^b	2.31 (1.67) ^b
2.	TNGSy-16	2.49 (1.72) ^a	2.79 (1.81) ^a	2.64 (1.77) ^a
3.	TNGSy-20	2.04 (1.59) ^c	2.32 (1.68) ^b	2.18 (1.63) ^b
4.	TNGSy-28	1.77 (1.50) ^d	2.04 (1.59) ^c	1.91 (1.55) ^c
5.	TNAU-Local	1.27 (1.32) ^e	1.39 (1.37) ^d	1.33 (1.34) ^d
SEm (±)		0.01	0.01	0.01
C.D. (P=0.05)		0.04	0.04	0.04

*Figures in parentheses are square root transformed values; With in column means followed by different letters are significantly different at 5% level of DMRT test

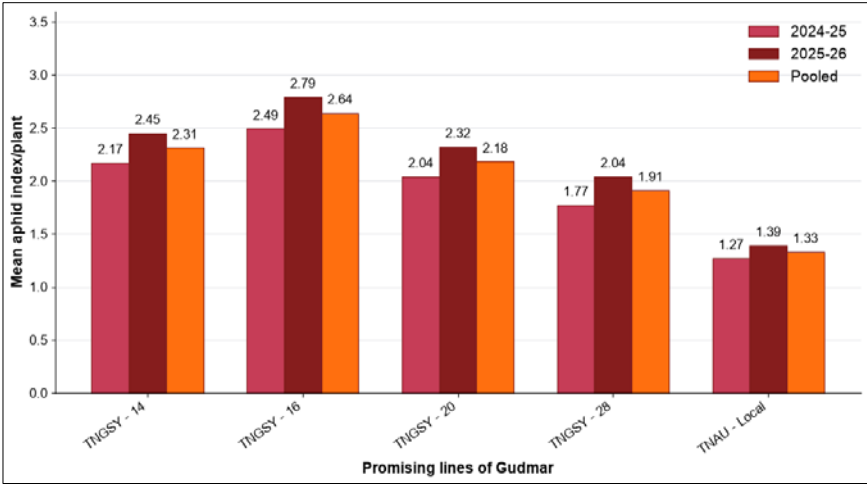


Fig 2: Mean aphid index on different promising lines of Gudmar

Table 3: Categorization of different promising lines of Gudmar for their relative susceptibility against Oleander aphid, *Aphis nerii* Fonscolombe

Categories of resistance	No. of promising lines	Scales of resistance	Promising lines of Gudmar
Highly resistant (HR)	1	$X_i < (X - sd)$ $X_i < 1.58$	TNAU-Local
Resistant (R)	1	$(X - sd) < X_i < X$ $1.58 < X_i < 2.07$	TNGSy-28
Susceptible (S)	2	$X < X_i < (X + sd)$ $2.07 < X_i < 2.57$	TNGSy-14, TNGSy-20
Highly susceptible (HS)	1	$(X + sd) < X_i < (X + 2 sd)$ $2.57 < X_i < 3.06$	TNGSy-16

*General mean (X) = 2.07; Standard deviation (sd) = 0.49

4. Discussion

The promising lines of Gudmar evaluated in the present study have not been studied by previous researchers. Therefore, the results regarding the susceptibility of promising lines of Gudmar to oleander aphid could not be discussed or compared in light of the earlier findings. Although, the field screening of 30 genotypes of Gudmar during the peak incidence of two invasive mealybug species, *Phenacoccus solenopsis* and *Paracoccus marginatus* revealed that the genotypes DGS-18, DGS-26, and DGS-28 were highly resistant, and DGS-13, DGS-15, DGS- 22, DGS-30 and DGS-33 were found resistant to them (Shivakumara *et al.*, 2024) ^[17].

5. Conclusion

A total of five promising lines of Gudmar, *Gymnema sylvestre* R. Br., were evaluated under field conditions to assess their relative susceptibility to the Oleander aphid, *Aphis nerii* Fonscolombe. The order of susceptibility of promising lines to aphid infestation was found as follows: TNGSy-16 > TNGSy-14 > TNGSy-20 > TNGSy-28 > TNAU-Local. Based on the statistical categorization of the promising lines of Gudmar, TNAU-Local was found to be highly resistant (HR), and TNGSy-28 was categorized as resistant (R), whereas TNGSy-14 and TNGSy-20 were grouped as susceptible (S), and TNGSy-16 was found to be highly susceptible (HS). The present study revealed considerable variation in the relative susceptibility among the promising lines of Gudmar to the oleander aphid. The identified relatively less susceptible lines may serve as valuable genetic resources for future screening and breeding programmes aimed at developing aphid-tolerant or resistant cultivars of Gudmar.

Incorporation of such resistant lines into pest management programmes could contribute to reducing dependence on insecticides, minimizing pesticide residues, and promoting environmentally sustainable management of oleander aphid. In contrast, the highly susceptible lines may serve as useful susceptible standards for future screening studies and investigations on host-insect interactions and aphid biology. Thus, the variation in susceptibility observed among the promising lines provides a useful basis for further research on host plant resistance and the development of sustainable management strategies for the oleander aphid in Gudmar.

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