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MORPHOLOGICAL CHARACTERIZATION OF SPIDER MITE (*Tetranychus urticae*: TETRANYCHIDAE) ASSOCIATED WITH OKRA IN DIFFERENT AGRO-ECOLOGICAL SITUATIONS OF GUJARAT INDIA

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ABSTRACT

The present investigation was undertaken to study the morphological variation of spider mite populations associated with okra collected from seven major okra-growing districts of Gujarat, namely Navsari, Anand, Surat, Tapi, Valsad, Narmada and Bharuch during 2025-2026. Adult female mites were collected, permanent microscopic slides were prepared using Hoyer's medium and detailed morphological character observations were recorded under microscope. Diagnostic characters including gnathosoma length, idiosoma length, dorsal and ventral body length, leg length, setae of hysterosoma length and chaetotoxy of hysterosoma were measured and statistically analysed. The morphological character observations revealed only minor quantitative variation among geographical populations. Female mites exhibited comparatively larger body dimensions than males for most measured characters. However, the overall morphological characters and chaetotaxy remained highly consistent among all populations. The present investigation provides comprehensive baseline morphological characters' information useful for spider mite taxonomy, biodiversity assessment and future DNA barcoding studies of *Tetranychus* populations associated with okra in Gujarat.

Keywords: Spider mite, Morphometrics, *Tetranychus*, Okra and Taxonomy

Introduction

Okra (*Abelmoschus esculentus* L.) is one of the most important vegetable crops cultivated extensively throughout tropical and subtropical regions of the world. India ranks first in both area and production of okra, contributing significantly to global vegetable production. The crop is valued for its nutritional composition, medicinal importance and economic returns to farmers. However, its productivity is severely affected by several insect and mite pests throughout the growing season, resulting in considerable yield and quality losses. Among the major arthropod pests, spider mites belonging to the family Tetranychidae are considered one of the most

economically important phytophagous mite groups because of their extremely short life cycle, high reproductive capacity and wide host range (Jeppson *et al.*, 1975; Zhang, 2003). Spider mites feed by piercing epidermal tissues and sucking plant cell contents, producing characteristic yellow speckling, chlorosis, bronzing, leaf curling and premature drying of leaves. Severe infestations ultimately reduce photosynthetic efficiency and crop productivity (Helle and Sabelis, 1985).

The genus *Tetranychus* includes numerous agriculturally important species that infest more than one thousand host plants worldwide (Zhang, 2003). Species identification within this genus has always been

challenging because of their minute body size and remarkable similarity in external morphology. Therefore, careful examination of taxonomically important structures such as the gnathosoma length, idiosoma length, dorsal and ventral body length, leg length, setae of hysterosoma length and chaetotoxy of hysterosoma (Gupta and Gupta, 1994; Krantz and Walter, 2009).

Several researchers have reported that although major diagnostic morphological characters remain relatively stable within species, slight morphometric variation may occur due to environmental conditions, host plant differences and geographical distribution (Navajas *et al.*, 1996a; Navajas *et al.*, 1996b; Ros and Breeuwer, 2007). Such studies provide valuable baseline information for biodiversity assessment and support molecular approaches such as DNA barcoding.

In Gujarat, spider mite infestation has become increasingly important in okra cultivation. However, comprehensive morphometric information on geographically separated populations is limited. Therefore, the present investigation was undertaken to characterize spider mite populations associated with okra collected from different agro-climatic regions of Gujarat using detailed morphological characters measurements.

Materials and Method

The present investigation was carried out during 2025-2026 at the Department of Plant Molecular Biology and



Fig. 1: Survey was conducted at farmers field locations across different districts of Gujarat

Biotechnology, NAU, Navsari and Department of Entomology, N. M. College of Agriculture, NAU, Navsari. The study was undertaken to characterized spider mite populations associated with okra collected from different agro-climatic regions of Gujarat through detailed morphological characters measurements.

Survey and Collection

Samples of okra leaves infested with spider mites were collected from different farmer field location Navsari, Anand, Surat, Tapi, Valsad, Narmada and Bharuch. Mite infested leaf samples were collected in polythene bags tied with rubber band from each crop field and brought to the laboratory and were observed under microscope (Pokle and Shukla (2015). Five randomly selected mite infested leaf samples were collected from each crop field. The survey was conducted at farmers field locations across different districts of Gujarat are presented in (Fig. 1).

Preservation of Mites

Collected spider mite infested leaves sample were observed under microscope and mites were collected with the help of needle and brush and preserved in 90 per cent alcohol in small plastic vials with tightly closed caps. These vials were labelled and kept properly for further studies (Kadu, 2019 and Arunima, 2017).

Maintenance of an Isoline

From the collected leaf samples single gravid female was carefully transferred into a fresh leaf placed over a moist cotton pad in a petriplate. The female subsequently laid numerous eggs which hatched successfully and developed into adults (Srinivasa *et al.*, 2012; Kadu, 2019). The adults obtained from this culture were collected and maintained as an isoline, as shown in (Fig. 2).

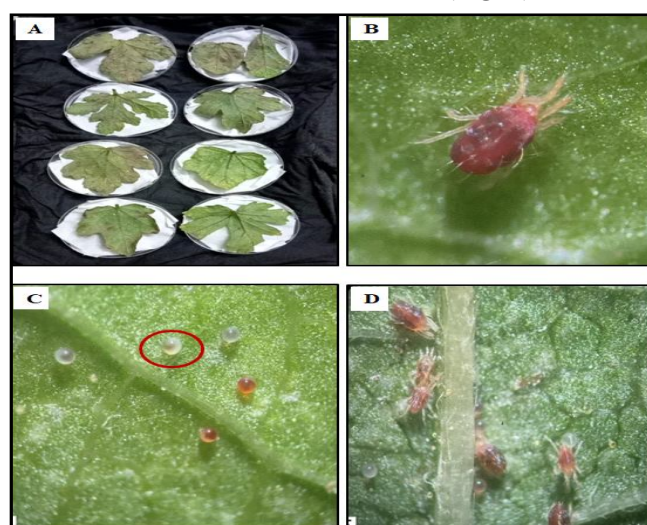


Fig. 2: Maintenance of isolines and different stages of spider mite A: Isolines, B: Gravid female, C: Eggs and D: Adults

Table 1: Morphological character measurements of spider mite females collected from different agro-climatic zone of Gujarat.

Sr. No.	Location	Gnathosoma length (mean $\pm$ SD)	Idiosoma length (mean $\pm$ SD)	Dorsum body length (mean $\pm$ SD)	Ventrum body length (mean $\pm$ SD)	Leg length (mean $\pm$ SD)	Setae of histosoma length (mean $\pm$ SD)
1	Navsari	278.05 $\pm$ 0.02	397.08 $\pm$ 0.02	675.13 $\pm$ 0.02	675.13 $\pm$ 0.02	319.07 $\pm$ 0.02	110.04 $\pm$ 0.02
2	Anand	278.06 $\pm$ 0.02	396.05 $\pm$ 0.01	674.11 $\pm$ 0.02	674.11 $\pm$ 0.02	319.70 $\pm$ 0.02	110.10 $\pm$ 0.02
3	Surat	277.10 $\pm$ 0.01	397.60 $\pm$ 0.02	674.70 $\pm$ 0.02	675.70 $\pm$ 0.02	317.05 $\pm$ 0.01	109.05 $\pm$ 0.01
4	Tapi	277.80 $\pm$ 0.02	396.30 $\pm$ 0.01	674.10 $\pm$ 0.02	674.10 $\pm$ 0.02	318.06 $\pm$ 0.02	109.41 $\pm$ 0.02
5	Valsad	277.07 $\pm$ 0.01	396.51 $\pm$ 0.02	673.58 $\pm$ 0.01	673.58 $\pm$ 0.01	319.08 $\pm$ 0.02	110.07 $\pm$ 0.02
6	Narmada	279.50 $\pm$ 0.02	397.81 $\pm$ 0.02	677.31 $\pm$ 0.02	677.31 $\pm$ 0.02	319.72 $\pm$ 0.02	110.91 $\pm$ 0.02
7	Bharuch	278.05 $\pm$ 0.02	396.05 $\pm$ 0.01	674.10 $\pm$ 0.02	674.10 $\pm$ 0.02	318.80 $\pm$ 0.02	109.81 $\pm$ 0.02

*Mean of 5 individuals; SD = Standard Deviation

Preparation of Permanent Microscopic Slide

Adult female and male mites from each isolate were selected for taxonomic studies. With the help of microscope the specimen were placed on the glass slide in the dorsal view with needle and pressed to the bottom of the slide to spread out the legs and the cover slip was placed with the help of needle on the top of specimen to avoid air bubbles. The mounted specimens were kept for drying, for five to ten days to get cleared and dried. Then after the edges of cover slips were completely sealed with the help of transparent nail polish to avoid the excessive moisture which can damage the specimen which are properly cleared and dried. These permanent slides (Fig. 3) were used for taxonomic studies (Gupta and Gupta, 1994; Krantz and Walter, 2009).

Morphological Character Measurements

The slide mounted specimens were observed under microscope to study the following morphological features: gnathosoma length, idiosoma length, dorsum body length,

ventrum body length, legs length, setae of histosoma length and chaetotoxy of hysterosoma (Krantz and Walter, 2009; Gupta and Gupta, 1994; Ehara, 1995; Samanta *et al.*, 2024).

Result and Discussion

Morphological Characterization of Female Spider Mites

Morphological characterization of adult female spider mites collected from seven agro-climatic regions of Gujarat revealed only slight quantitative variation among the populations (Table 1). The diagnostic morphological character measurements, including gnathosoma length, idiosoma length, dorsum body length, ventrum body length, leg length, setae of histosoma length and chaetotoxy of hysterosoma (Fig. 4). The mean gnathosoma length varied from 277.07 $\pm$ 0.01 μ m (Valsad) to 279.50 $\pm$ 0.02 μ m (Narmada), whereas idiosoma length ranged from 396.05 $\pm$ 0.01 μ m (Anand and Bharuch) to 397.81 $\pm$ 0.02 μ m (Narmada). The dorsum body length ranged between 673.58 $\pm$ 0.01 μ m (Valsad) and 677.31 $\pm$ 0.02 μ m (Narmada) while ventrum body length also exhibited only marginal variation among populations. Similarly, leg length varied from 317.05 $\pm$ 0.01 μ m (Surat) to 319.72 $\pm$ 0.02 μ m (Narmada). The length of histosoma setae ranged between 109.05 $\pm$ 0.01 μ m (Surat) to 110.91 $\pm$ 0.02 μ m (Narmada). Among all geographical populations, mites collected from Narmada exhibited comparatively higher measurements for most morphological characters, whereas Valsad, Surat and Tapi populations showed comparatively lower values. However, these differences were very small and did not alter the diagnostic morphological characteristics of the species. Similar observations were reported by (Gupta and Gupta, 1994; Krantz and Walter, 2009; Ros and Breeuwer, 2007 and Samanta *et al.*, 2024) who concluded that geographical populations of tetranychid mites generally exhibit only minor morphometric variation while retaining stable taxonomic characters.

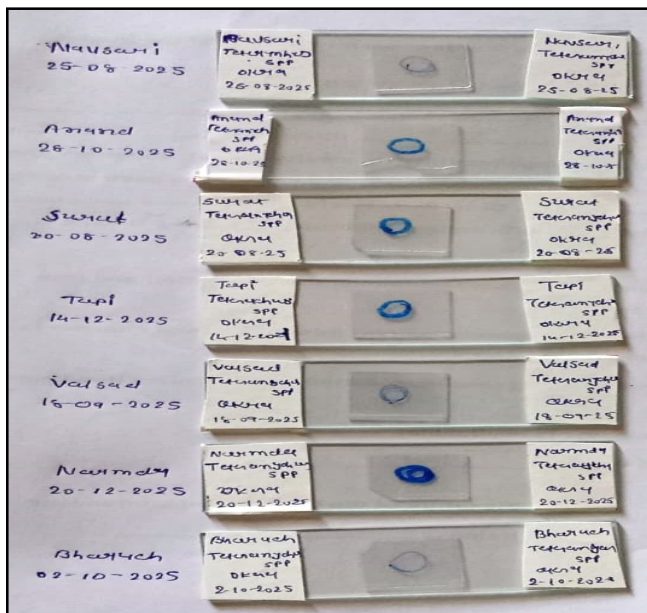
**Fig. 3:** Permanent microscopic slides of spider mite for morphological characters measurements.

Table 2: Morphological character measurements of spider mite males collected from different agro-climatic zone of Gujarat.

Sr. No.	Location	Gnathosoma length (mean ± SD)	Idiosoma length (mean ± SD)	Dorsum body length (mean ± SD)	Ventrum body length (mean ± SD)	Leg length (mean ± SD)	Setae of histosoma length (mean ± SD)
1	Navsari	274.31 ± 0.02	392.50 ± 0.02	664.81 ± 0.01	664.81 ± 0.01	315.05 ± 0.01	108.05 ± 0.01
2	Anand	274.03 ± 0.02	392.32 ± 0.02	666.35 ± 0.02	666.35 ± 0.02	316.51 ± 0.02	107.31 ± 0.01
3	Surat	273.51 ± 0.02	393.21 ± 0.02	666.72 ± 0.02	666.72 ± 0.02	315.81 ± 0.02	108.21 ± 0.02
4	Tapi	273.04 ± 0.01	393.10 ± 0.02	666.14 ± 0.02	666.14 ± 0.02	315.61 ± 0.02	109.10 ± 0.02
5	Valsad	273.03 ± 0.01	392.50 ± 0.01	665.53 ± 0.02	665.53 ± 0.02	315.56 ± 0.02	107.42 ± 0.01
6	Narmada	274.81 ± 0.02	393.80 ± 0.02	668.61 ± 0.02	668.61 ± 0.02	316.88 ± 0.02	108.91 ± 0.02
7	Bharuch	273.54 ± 0.02	392.11 ± 0.02	665.65 ± 0.02	665.65 ± 0.02	315.34 ± 0.01	108.31 ± 0.02

*Mean of 5 individuals; SD = Standard Deviation

The observed variation among populations may be associated with environmental conditions, host plant response and local agro-climatic factors rather than taxonomic differentiation. Previous investigations have also suggested that morphometric variation within a species is influenced by ecological conditions and geographical distribution (Navajas *et al.*, 1996a; Zhang, 2003).

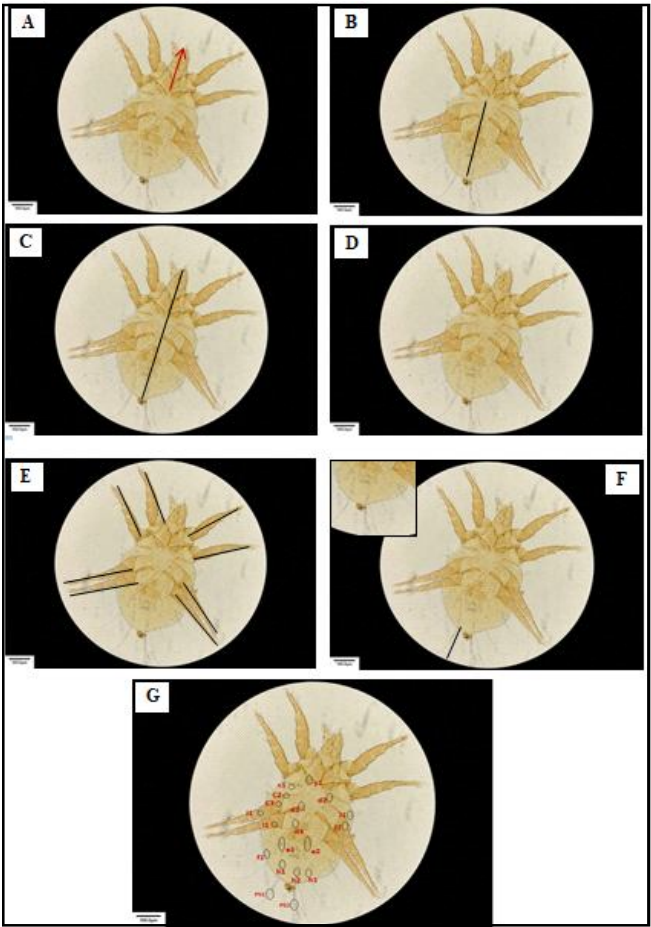


Fig. 4: Morphological characters of spider mite A: Gnathosoma length, B: Idiosoma length, C: Dorsum body length, D: Ventrum body length, E: Leg length, F: Setae of histosoma length and G: Chaetotoxy of hysterosoma.

Morphological Characterization of Male Spider Mites

Morphological characterization of adult male spider mites also indicated a high degree of similarity among the seven geographical populations (Table 2). Overall, male mites possessed comparatively smaller body measurements than females, which agree with the normal sexual dimorphism reported in tetranychid mites. The mean gnathosoma length ranged from 273.03 ± 0.01 µm (Valsad) to 274.81 ± 0.02 µm (Narmada), while idiosoma length varied between 392.11 ± 0.02 µm (Bharuch) and 393.80 ± 0.02 µm (Narmada). The dorsum body length ranged from 665.53 ± 0.02 µm to 668.61 ± 0.02 µm, whereas ventrum body length followed a similar trend. Leg length varied from 315.05 ± 0.01 µm (Navsari) to 316.88 ± 0.02 µm (Narmada). Setae of histosoma length ranged from 107.31 ± 0.01 µm (Anand) to 109.10 ± 0.02 µm (Tapi).

Although slight quantitative variation was observed among populations, all diagnostic morphological characters, including chaetotaxy and body structure, remained identical. These findings indicate that the populations belong to the same taxonomic entity despite originating from different agro-climatic regions. The present findings are in agreement with (Gupta and Gupta, 1994; Ehara, 1995; Krantz and Walter, 2009 and Ros and Breeuwer, 2007) who reported that male spider mites generally possess smaller morphometric dimensions than females, while preserving the characteristic diagnostic features used for species identification.

Overall, the present investigation demonstrates that spider mite populations associated with okra across Gujarat exhibit high morphological uniformity with only slight morphological variation. These findings provide valuable baseline information for future taxonomic, ecological and DNA barcoding studies.

Conclusion

The present investigation revealed only minor

morphometric variation among spider mite populations collected from seven agro-climatic regions of Gujarat. Female mites exhibited comparatively larger body measurements than males, while diagnostic morphological characters remained consistent in all populations. The observed morphometric differences are likely associated with environmental and geographical factors rather than species-level differentiation. Therefore, morphometric characterization continues to be a valuable tool for preliminary species identification and comparative taxonomic studies. The baseline information generated in the present investigation will be useful for future molecular characterization, DNA barcoding, biodiversity assessment and integrated management of spider mites associated with okra.

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References

- Arunima, V. (2017). DNA barcoding of spider mites (Prostigmata: Tetranychidae) on major crop plants of Kerala. *Thesis M.Sc. (Agri.)*, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala. 140.
- Ehara, S. (1995). A new species of *Tetranychus* (Acari, Tetranychidae). *Japanese Journal of Entomology*, **63**(1), 229-233.
- Gupta, S.K. and Gupta Y.N. (1994). A taxonomic review of Indian Tetranychidae (Acari: Prostigmata) with description of new species, redescription of known species and keys to genera and species. *Memoirs Zoological Survey of India*, **18**, 1-196.
- Helle, W. and Sabelis M.W. (1985). Spider mites, their biology, natural enemies and control. *Elsevier Science Publishers, Amsterdam*, **1**, 406.
- Jeppson, L.R., Keifer H.H. and Baker E.W. (1975). Mites injurious to economic plants. University of California Press. 614.
- Kadu, J.A. (2019). DNA barcoding of Tetranychid Mites (Acari: Prostigmata: Tetranychidae) of Some Horticultural Crops. *Thesis M.Sc. (Agri)*, Navsari Agricultural University, Navsari, Gujarat, India. 118.
- Krantz, G.W. and Walter D.E. (2009). *A Manual of Acarology*.
- Navajas, M., Fournier D., Lagnel J., Gutierrez J. and Boursot P. (1996a). Mitochondrial *COI* sequences in mites: evidence for variations in base composition. *Insect Molecular Biology*, **5**(4), 281-285.
- Navajas, M., Gutierrez J., Lagnel J. and Boursot P. (1996b). Mitochondrial cytochrome oxidase I in tetranychid mites: a comparison between molecular phylogeny and changes of morphological and life history traits. *Bulletin of Entomological Research*, **86**(4), 407-417.
- Pokle, P.P. and Shukla A. (2015). Biodiversity of spider mites (Family: Tetranychidae). *Rashtriya Krishi*, **10**(1), 88-89.
- Ros, V.I. and Breeuwer J.A. (2007). Spider mite (Acari: Tetranychidae) mitochondrial *COI* phylogeny reviewed: host plant relationships, phylogeography, reproductive parasites and barcoding. *Experimental and Applied Acarology*, **42**(4), 239-262.
- Samanta, S., Karmakar K. and Ueckermann E.A. (2024). Description of a new species of tetranychid mite and redescription of *Oligonychus sapienticolus* Gupta, 1976 (Acari: Prostigmata: Tetranychidae) from India. *Records of the Zoological Survey of India*, 103-111.
- Srinivasa, N., Gowda C., Mallik B. and Raghavendra P. (2012). New record of *Tetranychus truncates* (Ehara) as a potential pest from Karnataka. *Indian Journal of Entomology*, **74**(4), 379-383.
- Zhang Z.Q. (2003). Mites of greenhouses, identification, biology and control. CABI Publishing, Wallington, UK. 244.