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# A morphometric study of *Macrosiphum euphorbiae* (Thomas) (Hemiptera: Aphididae) on *Rosa* sp. from four different locations in Pune

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## Abstract
Morphometric studies were carried out on four populations of *Macrosiphum euphorbiae* (Hemiptera: Aphididae) associated with four varieties of *Rosa* sp. Ten morphological characters were measured and the mean value of each character was compared to the same of the other three populations collected from different sites. Out of the ten characters (body length, body width, head width, siphunculus length, processus terminalis length, basal antenal segment), only length of siphunculus, antennae, body, width of body and ultimate rostral segment length indicated the occurence of locally adapted populations. Morphometric analyses suggested not only the occurrence of four morphologically differentiated groups within *M. euphorbiae* from four isolated localities and but also a preference of undisturbed forest area against the urban or city area by the pest species. We have tried to study if aphids show response to genetic variation (rose varieties) in their host plant and local conditions.

**Keywords:** Aphid, host association, morphometry, local adaptations, taxonomic population

## Introduction
Insects under the family Aphididae are serious and stubborn sapsucking pests under order Hemiptera infesting agricultural and horticultural crops [1]. They directly damage plants by sucking their nutrients and causing reduced vigour by pouring toxic saliva [2]. They damage the crops by making leaf and stem galls besides secreting honeydew in high amounts causing disturbance in stomatal activity by blocking it, thus, reducing photosynthesis because of fungal development that invites viral diseases [2]. They are unique in having complex lifecycles with alternation of generation, multiple host plants, telescopic generations, polymorphism, high fecundity and parthenogenetic viviparity [3]. Temperate regions of the world show higher diversity of aphids than tropics [4]. Around 800 species are known from India and 385 of these are endemic [5]. Plant feeding population of insects and their population dynamics is influenced by the genetic variation of plants [6, 7]. Insets show variable ability to survive on different host plants [8, 9] and also varieties of the same plant species expecting that these plants are showing genetic variation [10]. Two of the *Chaitophorus populicola* aphid populations on *Populus angustifolia* evidently showed that they were adapted to the local host plant, in the third the herbivore was maladapted to the local host-plant population and in the fourth population had no evidence for adaptation [11].
This study deals with collections of *Macrosiphum euphorbiae* aphid samples feeding on four varieties of rose (red country rose variety, white bunchy rose variety, pink country rose variety and red tea rose variety) from four different locations in the Pune city and preparation of their morphological slides. Morphometric studies were conducted to trace any local morphological adaptations or existence of any host plant based populations supported by morphological adaptations.

## Materials and Methods
### A) Aphid collections
Individual's aphids of *M. euphorbiae* were collected from different varieties of rose plants (*Rosa* sp.). They occur as green and pinkish brown in life colour. The host plant species include red country rose var., white bunchy rose var., pink country rose var. and red tea rose var. (flower having fragrance like tea). Adult apterae aphids were collected with insect brush and stored in 10 ml vials containing 70% alcohol. Collection records of the Adult apterous

viviparous *M. euphorbiae* were cleared and mounted in Canada balsam on microscope slides.

**B) Character choice**

Ten standard morphological characters for aphids were scored [12, 13, 14]. Morphological measurements were made using a binocular transmission microscope fitted with a calibrated micrometer eyepiece [15]. Before the measurements were made, the microscope magnification was calibrated and kept undisturbed during the study. Body length (BL), body width (BW), caudal length (CAU), siphunculi (SIPH), last antennal segment (PT or Processus Terminalis), base of antenna (B-ANT), rostrum (ROST), ultimate rostral segment (URS), head (HEAD), total antennal length (ANT) were the characters studied. For each locality, 20 apterous adult aphids were taken for measurements.

*Macrosiphum euphorbiae* in life colour.

The representation for the four populations were done by numbering as follows - the SB Road population (from red country var.) numbered as 1, the AGC population (from white bunchy var.) numbered as 2, Camp population (from red tea var.) numbered as 3 and the Khadakwasla population (from country pink var.) was numbered as 4.

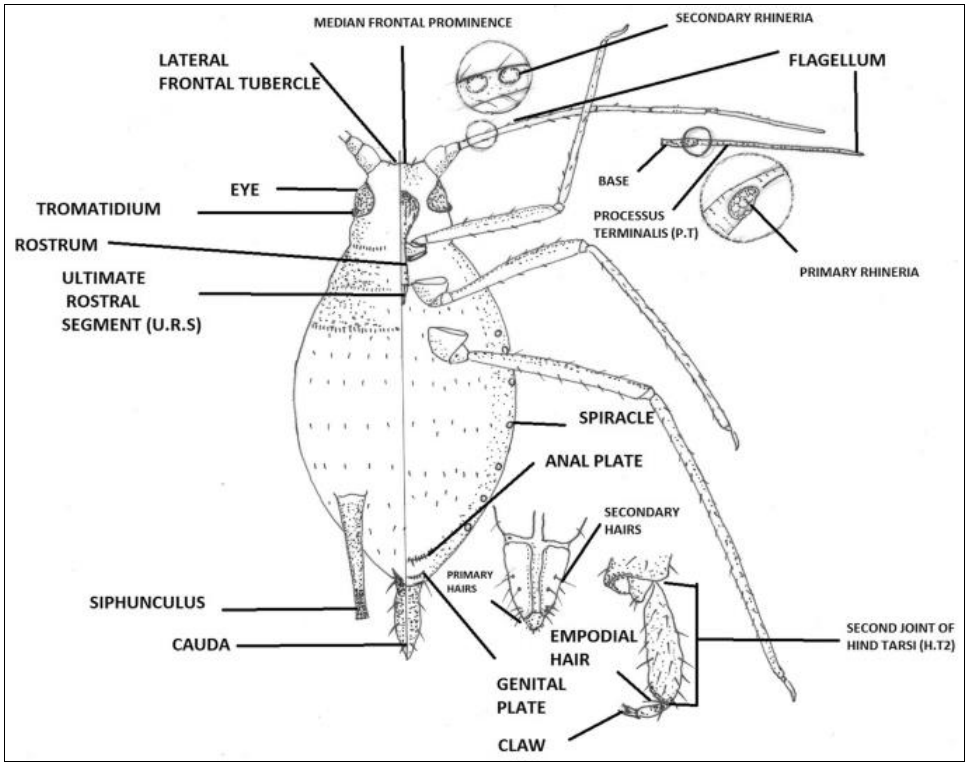



**Fig 1:** Characters of aphids dealt in this study (replicated from AFJ Dixon, 1994) [16]

**C) Data analysis:** The raw data was analysed through simple mean values and represented graphically

**Results**

The difference in morphometric data indicated the existence of four different locally adapted host plant based populations. Each of the ten characters was specifically distinguishable for the host plant. The BL, SIPH, PT, URS, B-ANT and ROST was highest in the Khadakwasla population, BW was highest in both AGC and Khadakwasla population, ANT was seen to be longest in the Camp population. The SB Road population showed smallest size in morphometry in almost all the ten characters. All measurements were pressed in milimeter scale (mm).

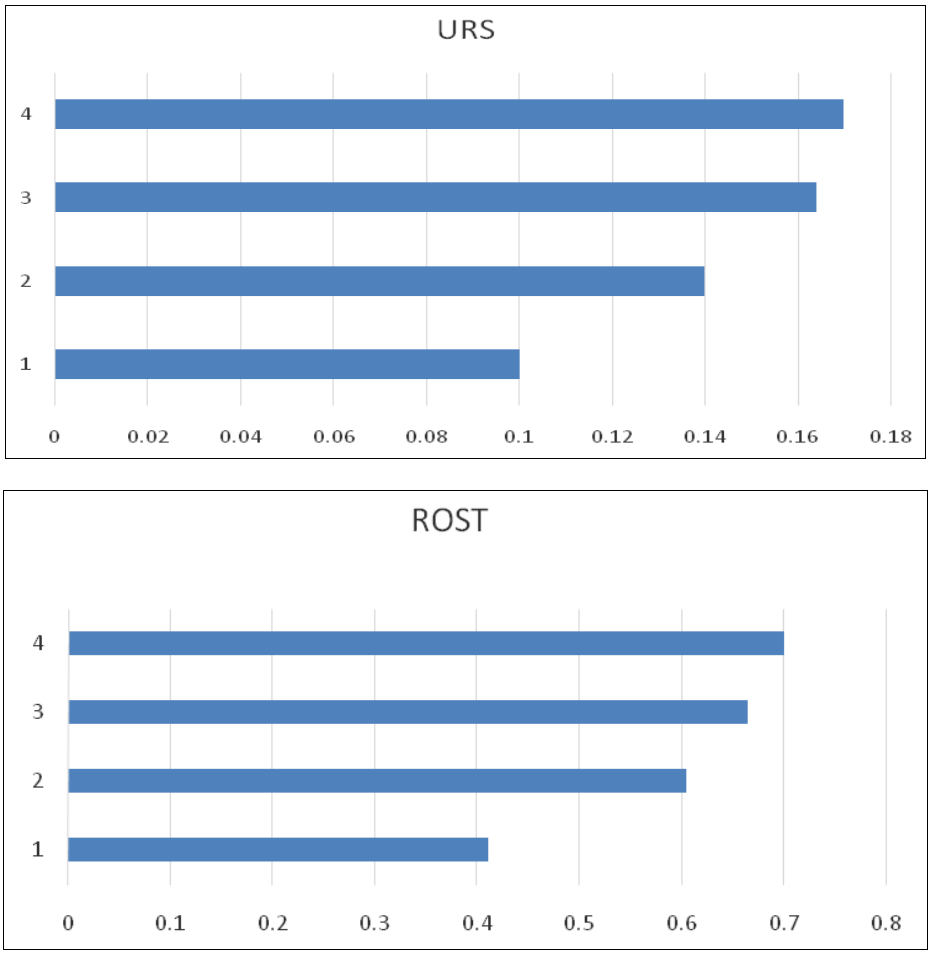
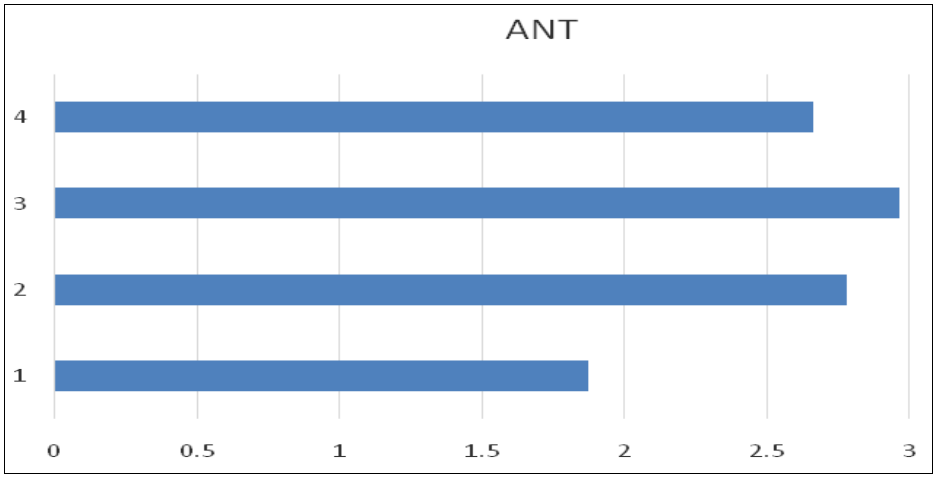



**Fig 2:** Comparison of the URS and ROST length for the four populations



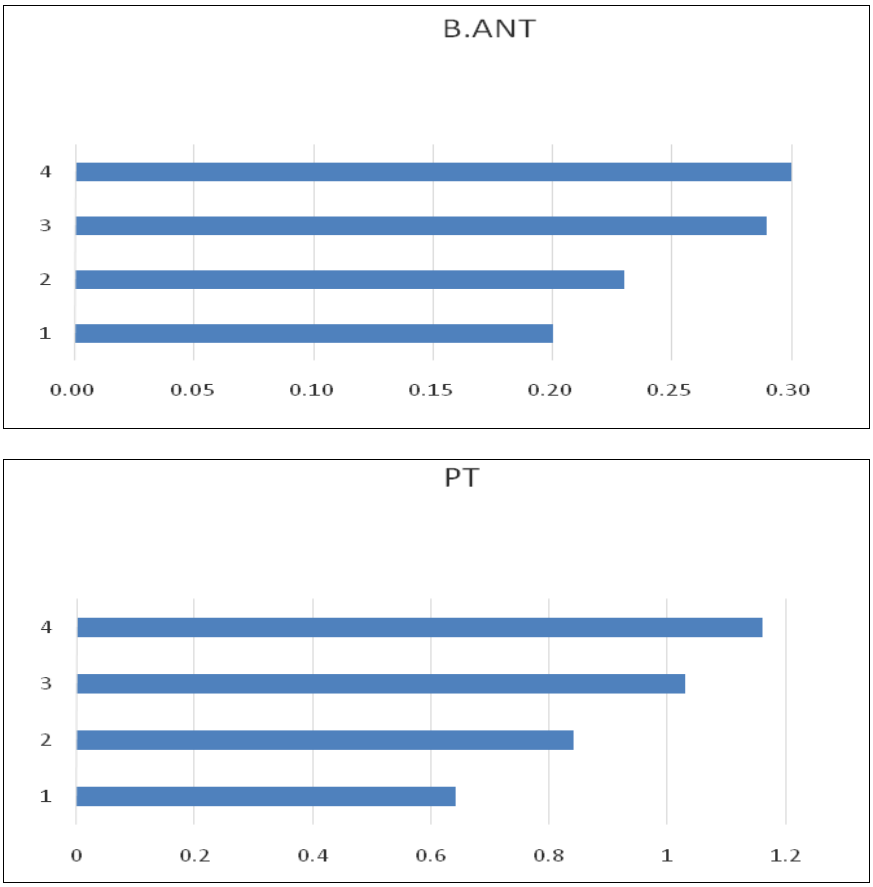



**Fig 3:** Comparison of ANT, B-ANT and PT

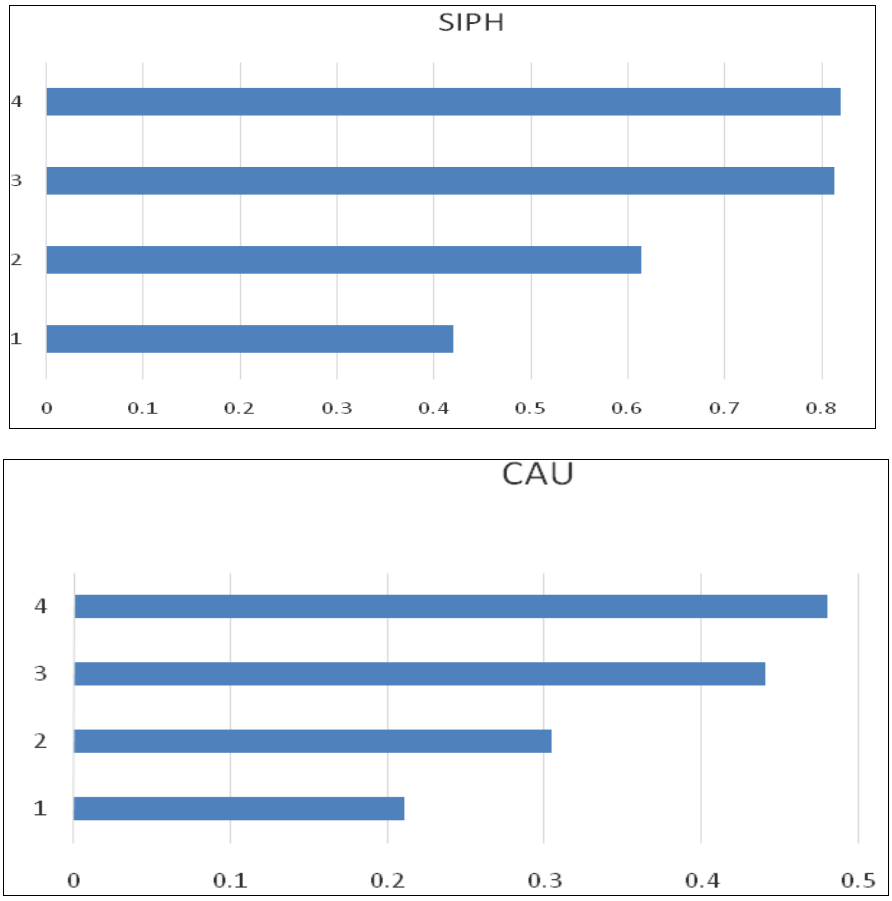



**Fig 4:** Comparison of SIPH and CAU length from the four populations

## Discussion

Each of the four populations of *Macrosiphum euphorbiae* in our study showed some or the other phenotypic difference in characters. Morphometric analyses indicated the existence of four morphologically differentiated groups within *M. euphorbiae* associated with the rose plant varieties providing evidence for the presence of four host-associated groups. In cottonwood plants, studies showed that similar genetic traits support similar communities [17]. The most important Characteristics observed in our study were the length of processus terminalis, siphunculus, rostrum and ultimate rostral segment. The siphunculus length in *M. euphorbiae* aphids in general is considerably larger than that of other aphid populations, a characteristic in which the population could be adapted to environmental conditions. The siphunculi are known to secrete alarm pheromones and probably aphids with longer siphunculi are able to release the alarm pheromone in a wider space [18]. Since the microclimatic conditions of that host plant are specific, all aphids and also *M. euphorbiae* are different from different host plants [19]. Rostral length on the other hand is associated with the ability of the aphid to reach deeper levels of phloem sap. Stronger siphunculi enable them to penetrate tougher plant tissue. The key character is the ultimate rostral segment that has a layer of chitin enabling the rostrum to make the incision in the host plant tissue. It also resists the flow of phloem sap. The Khadakwasla and Camp populations had longer rostrum and ultimate rostral segment. The aphids sense their host plant tissue having mucilaginous cells and other chemical secretions with the antennae especially the *processus terminalis*. Longer antennae in the Camp population is an indication of the better adaptibility of the population to sense the host tissue for the depth to which phloem is located.

Further studies are to be done regarding the genetic variation of the host plants supporting the same phloem feeder populations of the same aphid. The biological studies and ecological studies of the aphid are to be visited to support our current findings.

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