IS ACERIA MANGIFERA SAYED (ACARINA: ERIOPHIDAE) RESPONSIBLE FOR CAUSING MALFORMATION OF INFLORESCENCE IN MANGO?

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High infestation of vegetative and floral parts of mango with *Aceria manifera* Sayed has led to the belief that the Eriophyid mite is the cause of malformation. *A. mangifera* is widely distributed and is omnipresent in almost all mango nurseries and orchards in West Pakistan. The mite is exclusively confined to the mango plants and attacks well developed vegetative buds and the primary fruit buds. The mite lives within the whorls of the leaves of the buds in colonies and causes partial or complete death of the buds, but does not directly cause malformation of vegetative buds or inflorescence. Direct transfer of eriophyid mites from malformed inflorescence of mango plants to the buds of twenty healthy nursery plants did not induce malformation, though the mite continued breeding and damaging the buds of the host for eleven months.

INTRODUCTION

Malformation of inflorescence is a very serious disease of mango (*Mangifera indica* L.) in West Pakistan. The disease affects vegetative parts of mango plants of all ages and turns the inflorescence into bunchy structures which do not bear fruit. Mites have been accused to cause it (Ahmad and Anwar, 1965). The disease is attributed to physiological disturbance (Khan and Khan, 1962; Sattar, 1946), whereas the possible viral nature of the disease has also been suspected (Sattar, 1946; Kausar, 1959).

The malformed branches and inflorescence attract insects belonging to *Lepidoptera*, *Coleoptera*, *Hemiptera* and *Thysanoptera*, and two species of Acarina mites belonging to the families *Eriophidae* and *Phytoseidae*. Recently, Ahmad and Anwar (1965) blamed the eriophyid mite, *Aceria mangifera* Sayed, as the cause of malformation. These authors referred to some Indian workers including Narasimhan (1954, 1959), Nariani and Seth (1962), Singh (1955), Pattarudhriah and Basawana (1961), in support of their conclusion. However, Latif *et al.* (1961) gave their verdict against the mites and insects.

The present paper reports observations made to study the role of the mite *Aceria mangifera* in causing malformation in mango, its status and economic importance as a pest, age of mango plants in relation to susceptibility to the mite, susceptibility of inflorescence or vegetative parts to the mite, and the ecological conditions most favourable for its development.

REVIEW OF LITERATURE

The nature of damage caused by species of *Eriophyidae* indicate that some of them cause mere browning and scarification, others produce galls, some produce malformation, deformation, blistering and dwarfing.

Keifer (1960) reported that *Aceria tutlei* lives in the buds of *Aster spinosus* under leaf bases and causes a terminal proliferation of buds and plant stunting. Likewise, *Aceria agrophyronia* was reported to attack *Diospyros virginiana* and cause small bead-galls protruding on the upper leaf surface and opening on the lower surface. Another species, *Aceria vaga* was stated to live along the veins of leaves of *Carla illinoensis* and to cause discoloured spots. Similarly, *Aceria arbutifloria* is known to attack blossom heads of *Arbutus menziosii* and to live in the bracts at the bases of flower stalks and causes browning of the tissues.

Keido and Stafford (1955) recorded *Eriophyia vitis* as causing deformation of primordial clusters of vine, distortion of basal leaves, stunning of main growing point of the bud, and death of the overwintered buds. Similarly, Smith and Stafford (1945) reported *Eriophysis vitis* causing short basal internodes, scarification of bark of new shoots, dead terminal buds, witches broom growth of new shoots, zigzag shoots and dead overwintered buds on grape vine, but leaf galls are not caused. Likewise, Metcalf and Flint (1962) stated that *Eriphysi pyri* produces brownish blisters on the underside of leaves of pear and apple. Fruit buds turn brownish, flare open, produce weak flowers, and russeted, globular and misshappened fruit, dwarfing and malformation. *Eriophysis insiduous* causes peach mosaic.

However, Narasimhan (1954, 1959), Singh (1955), Pattarudiah and Basawana (1961), and Nariani and Seth (1946) from India and Ahmad and Anwar (1956) from Pakistan have attributed malformation of inflorescence and vegetative buds in mango to *Eriophyid* and *Tyrophagus* mites. On the other hand, Latif *et al.* (1961) reported that by spraying mango plants with EPN 300, Basudin 60E and Foserno 50, mites and insects were controlled but malformation reappeared, although malformed shoots had been removed before spraying. From these results, they concluded that malformation was not caused by the mites on mango.

Slykhuis (1963) reported the transmission of six viruses by Eriophyid mites and the transmission of several others was suspected.

MATERIALS AND METHODS

The observations reported in this paper were made on 42 mango trees at the West Regional Laboratories, Lahore, one tree at 51/3 Lawrence Road,

Lahore, 83 ungrafted nursery mango plants at the West Regional Laboratories, Lahore, 4000 ungrafted and 640 grafted plants in the Model Nurseries, Model Town, Lahore.

To study the exact nature of damage done by the eriophyid mite, infested buds were thoroughly examined and sections of healthy and infested buds were studied.

To obtain direct evidence whether eriophyid mites can cause malformation, the mites (*A. mangifera*) were directly transferred to healthy plants in January, 1966 and the observations were continued till November, 1966.

RESULTS AND DISCUSSION

Host Range of the Mite: Numerous fruit trees, other trees, plants and wild vegetation in the vicinity of the mango trees were examined for the presence of the mite. However, *Aceria mangifera* was not found on any of these plants. Evidently, mango is the only host of the mite.

Age of Mango Trees and Intensity of Attack: The mite was observed to attack mango plants of all ages, from nursery stage to the oldest trees. Well developed buds of invariably all mango plants of all ages, irrespective of their location were infested with the mite. The localities examined were in Lahore, Lyallpur, Sheikhupura, Mianwali and Sargodha Districts. Shoots of mango picked up at random from mango trees showed that the well-developed buds had all stages of the mite within the folds of buds.

Parts of Mango Plant Attacked: Only well developed vegetative buds of the shoots and branches were observed to be attacked by the mite. Immature buds are not generally attacked. However, in the case of inflorescence, only the primary fruit buds are attacked. The buds sprouting on the flowering shoots are not attacked. This means that once the flowering shoot has sprung out of the primary bud, it is safe from the ravages of the mite. The mites were neither seen attacking under-developed buds nor the flower buds of the inflorescence.

Location of Mites in the Buds: No other parts of the mango plant except the vegetative and floral buds were observed to be attacked by the mite. Median longitudinal sections of the buds (Fig. 1) showed that the mites were located on the inner side of the outermost whorl of leaves of the bud, inner as well as outer sides next to outermost leaves, and gradually penetrated to the inner whorls depending on the severity of infestation. In case of severe infestation, all the leaves of the various whorls were attacked and the mites were present in the innermost parts of the bud as well.

Each bud leaf showed nymphs as well as grown up mites in groups with a population of 7 to 34 mites. In majority of cases, 13 to 25 mites per leaf of

bud were found in groups, and occasionally were just scattered over the leaf of bud. More than 2000 buds examined under the binocular microscope from

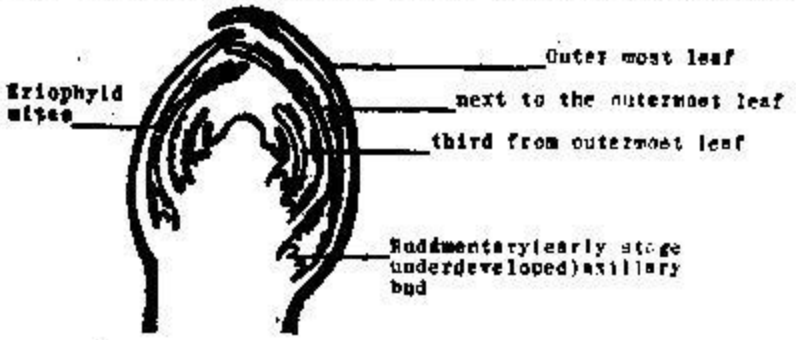

Fig. 1. Median longitudinal section of a bud of mango showing location of mites.

20th December, 1965 to 28th March, 1966 showed, that on an average, 2.55 mites were found on each bud.

However, buds of malformed shoots and malformed inflorescence showed a very high population of mites during December to March. There were 650 to 800 mites per bud within its various leaf whorls. The malformed tissues are more succulent and are capable of supplying more food, better shelter and hiding place than vegetative buds, and, therefore, have a higher number of mites. Besides mites, insects belonging to different orders are also found in the malformed inflorescence and continue to breed in these big bunchy and juicy tissues.

Nature of Damage done by the Mite: The chelicerae are inserted by the mites into the leaf tissue of the bud. The pedipals help them in directing, inserting and also acting as accessory appendages in lacerating the tissues. The sap is sucked. The mites are sedentary in habit and feed in groups at one place. As a result of continued feeding in groups at one place, the area turns brown to dark brown and finally gets scortched and dies. The mites then shift to the neighbouring places and destroy it. Feeding and shifting to nearby places continues till the entire leaf of the bud is destroyed. At first the outer three whorls are destroyed, then the inner whorls, till finally the entire bud is destroyed. Sometimes, the outer three whorls are destroyed only and the inner whorls remain safe and are capable of sprouting and growing into a shoot or an inflorescence. After the death of the bud, new buds sprout in the vicinity.

Partial or complete death of the bud was the only end result of eriophyid mite attack on the buds and shoots and malformation was never observed, even after very prolonged and continuous attack (Fig. 2 and 3). Trees or plants without any previous history of malformation did not reduce malformation in spite of 100 per cent bud infestation with the mites. Thus, the exact

nature of damage done by this mite is the destruction of the well developed buds of mango plants of all ages from the nursery stage to the grown up trees. The

Fig. 2. Terminal bud of a mango shoot scorched and killed by the mite.

Fig. 3. Mango inflorescence showing bud killed by Eriophyid mites.

damage may be partial and the bud may sprout and grow into a branch or may perish inducing the neighbouring area to produce the buds and branches. Thus, the mite, in fact, is a pest of the mango buds.

Role of Aceria mangifera in the causation of malformation directly. Co-existence of eriophyid mite and malformation of mango in mango gardens has lead many to believe that mites cause malformation. However, this is not the case. The following observations are recorded in support of this:

(a) Twenty mango nursery plants in best health, 3 to 4 years' old and 3 to 4 feet in height were artificially infested with eriophyid mite transferred from malformed branches as well as from branches without malformation in January, 1966. Observations were continued till November, 1966. The mites lived and continued breeding and damaging buds but no malformation was caused in any case. Even the sap from malformed vegetative parts was inoculated, or rubbed on bruised surface of shoots in some cases and this too did not produce any malformation.

(b) A very carefull examination of 4723 nursery plants and 43 grown up trees has shown that numerous instances exist where in spite of very heavy mite attack there is no malformation of vegetative parts or of inflorescence. Mites were observed on 100 per cent mango trees, but malformation was seen on 7 to 34 per cent nursery plants and from 0 to 75 per cent of plants under observation.

These observations indicate that neither malformation of shoots nor that of inflorescence can be caused by the eriophyid mite.

Natural Control of Aceria Mangifera: During the course of this investigation, two natural methods of control of *Aceria mangifera* were observed.

During spring months when mango tree commenced flowering, the growth of their vegetative buds stopped. Thus, the vegetative buds remained mostly immature. Since the mite attacks well-developed buds only, the incidence of mite attack on buds greatly dwindled down. During these days, the primary buds of flowers had produced inflorescence. Because the mite does not attack secondary flower buds on the inflorescence, the population of the mite on the inflorescence also dwindled down.

A Cheyleitid mite (Family Cheyletidae) was observed as a predator of *Aceria mangifera*. It was fairly common among the colonies of the mite.

Conclusions

In conclusion, the observations reported in the previous pages show that *Aceria mangifera* is a specific pest of *Mangifera indica*. The mite exclusively attacks well developed vegetative buds, and the primary buds of the inflorescence. It does not attack immature buds, nor does it attack flower buds of the inflorescence other than the primary buds. All stages of mite are located in colonies or sometimes scattered on the inner surface of the outermost leaf whorls, and on buds on outer as well as inner surfaces of inner whorls. The infested parts become brownish, dark brown and finally get completely scortched.

The buds may completely perish or the inner whorls of leaves may remain intact, sprout and grow to a normal branch or normal inflorescence. No malformation of any type is caused directly by the mite. The mite is at best a pest causing minor damage.

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