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Studies on Genus *Aceria* (Von Siebold) in Eygpt

A THESIS

Submitted in Partial Fulfillment of the requirements for the

MASTER Degree

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Cairo

1443 – 2022

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II-REVIEW OF LITERATURE

1- Survey of Eriophyid mites belonging to genus *Aceria* Keifer.

Zaher *et al.* (1969) stated that *Phytoseius finitimus* Ribaga among the most important predator of phytophagous mites infesting fruit trees in Egypt. The considerable number of this predator encountered on fig at times of absence of *Eriophyes ficus* infestation suggested that food other than the eriophyid mite played an important role in the survival of this phytoseiid mite.

Rasmy and El Banhawy (1974) demonstrated that the eriophyid mite, *E. ficus* is a preferable prey for the predator mite *P. finitimus*. *Tetranycus urticae* is also a favorable prey for the predator but it seems to be a secondary prey. The capability of *P. finitimus* to survive on pollen favors this predator to exist in the field during the markedly suppressed the egg production of the predator. This would explain the frequent occurrence of this predators mite on fruit trees during the absence of phytophagous mites.

Jeppson, *et al* (1975) noted that all stages of *E. ficus* were present in and around buds in Winter. As buds break in spring the mites move to stems and leaves and begin laying eggs. Most eggs are deposited among lower leaf surface hairs. Development of this mite from egg to adult requires 5 to 7 days. Population of *E. ficus* increases more rapidly on plants supplied with optimum nutrients than on plants deficient in nitrogen phosphorus.

Abou-Awad (1976) recorded *E. ficus* Cotté, *Rhyncaphytoptus ficifoliae* and *Diptilomious ficus* on fig trees.

Nachev (1976) observed that *Eriophyes pyri* hibernating in the buds and in cracks of the bark. The mite resumed their activity in late March or early April, where they migrated to the leaves, increase singly slowly and reach a peak density of 120-150 mites per leaf only in August. During a survey of mites associated with fig trees in Egypt, **Abou-Awad (1976)** showed that, the phytoseiid predator, *P. finitimus* was prevalent and the eriophyid mite, *E. ficus* was the main acarine pest. Recent field of *P. finitimus* correlated positively with the population of *E. ficus*, which reached a noxious level on fig trees.

El-Adel (1982) surveyed *E. ficus* Cotté on fig (Ficus carica L.) trees. He also observed that, this species was infested fruits, buds and new & old leaves with high number in Alexandria governorate.

El-Halawany *et al.* (1986) stated that, Sultani fig variety trees were highly infested with *E. ficus*, while Adsi fig variety trees were moderately attacked. He also found that *E. ficus* infesting the lower leaf surface, buds and fruits, preferring the new leaves.

Al-Mallah and Mohammad (1989) reported that *Rhyncaphytoptus ficifoliae* began to appear on the leaflet of fig trees in Iraq in April and reached its peak on the 3^{rd} and 4^{th} week of June during two successive years. There was a significant positive correlation with relative humidity.

El-Halawany *et al.* (1990) studied the population dynamics of the eriophyid mite *E. ficus* Cotté and its predaceous mite, *P. finitimus* Ribaga in fig orchards near Alexandria. *E. Ficus* proved to be the main acarine pest infesting the two fig varieties Sultani and Adsi, and had two annual peaks of seasonal abundance in October and June on young leaves. On old leaves, it had one annual peak of seasonal abundance in May on

Adsi fig variety while on Sultani variety two peaks were indicated in June and October during the successive years. In buds, it had only one annual peak during January. The predator mite *P. finitimus* appeared on both young and old leaves of Sultani and Adsi varieties in May, and then increased in number from May to August during the two successive years of study.

El-Halawany and Abdel-Samad (1990a) mentioned that, the Sultani variety was more susceptible to *E. ficus* and *T. urticae* infestation than Adsi variety during the two successive years (July 1984 to June1986). The total number of *E. ficus* and *T. arabicus* per 100 leaves during the two successive years were 240284, 63626 and 98436, 24631 individuals for Sultani and Adsi fig varieties, respectively.

El-Halawany and Abdel-Samad (1990b) recorded new species *Amblyseius ficus* from debris and leaves of fig trees (Ficus carica L.) in Al - Qalubiya and Alexandria. The same authors **(1990a)** reported forty predaceous mite species belonging to 14 families and 20 genera were registered; six species are considered new from fig orchards. The predator mite *P. finitimus* Ribaga is common predators on fig trees, *Amblyseius cydnodactylon* Shehata and Zaher in Al-Qalubia, and Agistemus *externut* was collected.

Villabobos and Espinosa (1990) stated that, during a survey carried out on the eriophyid mites, they found that, *Eriophyes ficus* Cotté associated with fig trees in Mexico.

Heikal *et al.* (1996) indicated that four predaceous mites, inhabiting fig trees. The phytoseiid mite *Amblyseius swirskii* (A-H.) and *Agistemus exsertus* Gonzalez were the most common predators mites, while the phytoseiid mite *P. finitimus* Ribaga and the *Eupalopsellid* mite, *Saniosulus nudus* summers were observed in noticeable numbers on fig trees. Also, they found three phytophagous mites, the two-spotted spider mite, *Tetranychus arabicus* Attiah and the tenuipalpid mite, *Brevipalpus phoenicis* (Geijskes) was rarely captured, while the eriophyid mite *E. ficus* Cotté was occasional pest, on fig trees in Al- Qaluobia Governorate.

Budai, *et al.* (1997) reported that *Aceria tulipae* caused damaging garlic bulbs and damage has become more conspicuous as a result of the recent hot dry summers.

Shibao and Tanaka (1997) studied the overwintering sites and stages of fig bud mite, *E. ficus (Aceria ficus)* in an open fig field in Japan in dormant fig bud from January to March. The number of overwintering adults was greater in big dormant buds than in small dormant buds.

Navia (1999) recorded two new eriophyid mites (Acari: Eriophyidae) *Aceria cordata* sp. nov. and *Tetra striata* sp. nov. (Acari: Eriophyidae) on leaf erineum galls with the fruit tree *Matisia cordata* (Bombacaceae).

In Sao Carlos, Sao Paulo, Brazil **Flechtmann (2000)** recorded two new species of eriophyid mites, *Aceria zoostrix* n. sp. and *Aceria aristidae* n. sp. (Acari: Prostigmata), on *Aristida sp. (*Poaceae) grass.

Abou-Awad *et al.* (2000) recognized that three phytophagous species consisted of the fig bud mite, *A. ficus*, the fig leaf mite, *Rhyncaphytoptus ficifoliae* Keifer and two spotted spider mites *T. urticae* Koch, representing a basic trophic level, were fed upon by three of predacious mites *Amblyseius swirskii* Athias Henriot, *Pronematus ubiquitus* (McGregor) and *Agistemus exaertus* Gonzalez. Population abundance of the injurious mites was affected by the prevailing climatic condition, action of predators and leaf age.

Navia and Flechtmann (2000) described eriophyid mites *Aceria mangifera* Sayed and the protogyne of *Cisaberoptus kenyae* Keifer for the first time on mango plants.

In India, **Umapathy and Mohanasundaram (2000)** recorded five new species of gall-forming eriophyid mites as, *Aceria allophylae, A. apodytae, A. ariyankavensis, A. articulate* and *A. attakattiensis* on different plant hosts.

Pandit and Chakrabarti (2000). described new genus, *Protumescoptes* and four new species, *Aceria fissistigmae* sp. nov. *Aculops jalpaiguriensis.sp.* nov. *Proctoscopes antedesmae* sp. nov., and *Vasates lakoochae* sp. nov.

In Chile**, Zhao-Jian *and Kuag-Haiyuan.* (2000)** surveyed three species of the family Eriophyidae *Sinacus caricae*, *Aceria eltidis* and *Tegolophus salicis* on fig trees.

El-Halawany (2001) noted that, the fig bud mite *E. ficus* Cotté (*Aceria ficus*) was the main pest infesting fig trees. The individuals were observed with greater numbers on lower surface of young leaves than the old leaves with two peaks of seasonal abundance. One in June and other in November. The population of *E. ficus* was significant positive correlated with temperature, while, the relative humidity was non-significant correlated.

Jagadiswari Rao *et al.* (2001) reported.eriophyid mite, *Aceria gurreronis* Keifer on coconut (*Cocos nucifera* L.) for the first time in coastal Orissa, India.

De-Lillo *et al.* (2002) described three new *Aceria species* (Acari: Eriophyoidea) on *Centaurea spp*. (Asteraceae), they were discovered. *Aceria solcentaureae* sp. nov, *Aceria solstitialis* sp. nov. on *Centaurea solstitialis* L., whereas *Aceria squarrosae* sp. nov.was associated with *Centaurea squarrosa* L.

In Spain, **Nunez *et al.* (2002)** reported *Aceria neocynarae* (Keifer) for the first time in 1998 on artichoke plants when this species had been recorded in California (USA), Egypt and Sicily (Italy) only.

Ostoja-Starzewski (2002). Recorded eriophyid mites *A. ficus* Cotté and *Rhyncaphytoptus ficifoliae* Keifer in B ritish from the leaves of fig, *Ficus carica* L. for the first time between July and October.

Dhooria and Bhullar (2003) recorded 20 eriophyid mites through extensive surveys on the occurrence and pest status of eriophyid mites out on different economic plants at different localities of Punjab, India.

Halawa, (2003) found that, the predacious mites from families Stigmeidae and Phytoseiidae and Chelitidae were associated with *A. ficus* on each sultani and Adsi varieties.

Beevi *et al.* (2004) found three species of phytoseiids, *Amblyseius largoensis, A. nucifera*and and *A. alstoniae* feeding on the contents of the eggs, nymphs and adults of *Aceria guerreronis as* predators during survey in Kerala, India.

Sujatha, and Rao (2004) recorded the coconut mite (*A. guerreronis*) in Andhra Pradesh, India, for the first time in 1999.

In Iran **Xiao Yue *et al.* (2005)** described two new species of eriophyid mites, *Acalitus alnusae* n. sp. from *Alnus glutinosa* (L.) and *Aceria castaneifoliae* n. sp. from *Quercus castaneifolia* C. A. Mey. On the other hand, *Aceria geranii (*Canestrini) and Aceria *pterocaryae* Kuang and Gong were recorded for first time.

In Iran **Kamali and Amrine (2005)** described two new species, *Aceria scariolae* n. sp. infesting *Lactuca orientalis* Boiss. (Asteraceae) and *Aceria cousiniae* n. sp. infesting *Cousinia eryngiodes* Boiss. (Asteraceae).

In India **Nair *et al*. (2005)** reported that, the *A. guerreronis* was a potential pest of coconut.

Beevi *et al.* (2006) studied the effects of eriophyid mite, *A. guerreronis* Keifer on germination and seedling characters of coconut.

In Turkey, **Cetin, and Alaoglu (2006)** demonstrated that, the eriophyid mites, *Aculus olearius* Castagnoli and *Aceria olea* (Nalepa) were found in the fruit pit of immature fruits. The first species was thought to be a new record for during studies in 9 olive orchards in 3 villages in Mersin, Turkey, during 2001-2002, at the end of May, population density reached maximum levels and 80-100 mites were observed within one colony. After the first week of June, the population density began to illustrated reduce and in the last week mites that migrated from fruits to leaves didn't form colonies on the leaves.

In Turkey, **Denizhan *et al.* (2006)** described three new *Aceria* species, *Aceria eglnirae* n. sp. from *Althaea rosae* (L.) (Malvaceae), *A. tinctoriae* n. sp. from *Anthemis tinctoria* L. (Asteraceae) and *A. ankarensis* n. sp. from *Dianthus chinensis* L. (Caryophyllaceae). Moreover, no injuries were detected on the host plants.

Rancic *et al.* (2006) *Aceria anthocoptes* (Nalepa) was the only eriophyid mite that had been recorded on *Cerastium arvense* L. worldwide and caused injury by feeding on the leaves of *C. arvense* results in visible russeting and bronzing of the leaves.

In South America **Navia, *et al.* (2006)** recorded *Aceria tosichella* Keifer (Acari: Eriophyidae) for the first time on wheat crops**.**

Balaji and Hemavathy (2007) observed the peak incidence of A.guerreronis during dry climate April, May and June and started declining during wet climate at July.

In Turkey, **Denizhan *et al.* (2007)** described three new eriophyid mite species *Anthocoptes trigonellae*n. sp. on *Trigonella* sp., *Aceria novellae* n. sp. on *Hedysarum* sp., and *Tetra glycyrrhizae*n. sp. on *Glycyrrhiza glabra* L. and reported that, these mites did not cause any apparent symptoms to their hosts**.**

In Brazil, **Flechtmann and Santana (2007)** described *Aceria anisodorsum*n. Sp. from protogynes, males and deutogynes that occurring simultaneously as leaf vagrants on *Caesalpinia peltophoroides* Benth that collected in early spring**.**

In Finland, **Skoracka *et al.* (2008)** described two new species of grass-feeding eriophyid mites *Aceria arenariae* sp. nov. inhabiting European beach grass and *Aculochetus blaszaki* sp. nov. inhabiting purple moor grass.

Desai *et al.* (2009) recorded infestation level of coconut eriophyid mite, *Aceria guerreronis* Keifer in Konkan region of Maharashtra. in April and October of 2004 and March 2005. The survey indicated that the infestation was higher in Thane district followed by Sindhudurg district.

In South America, **Castiglioni and Navia (2010)** isolated Wheat curl Mite, *Aceria tosichella* Keifer (Prostigmata: Eriophyidae) for the first in Uruguay.

In Southern Bohemia **Maca (2012) identified** a b o ut 27 species of eriophyoid mites including *Aceria horrida* (Nalepa), *A. lycopersic*i (Wolffenstein) and *Epitrimerus filipendulae* (Liro), for the first time.

Rajan *et al*. (2012) recorded *A. guerreronis* in two districts of Andhra Pradesh, India in November 2011 to assess the level of coconut eriophyid mite.

Al-Shanfari *et al.* (2013) reported that, the damage of coconut fruits by the eriophyid mite *A. guerreronis* Keifer was observed in that region in the late 1980s, but background information about the ecology of the pest in Oman was missing. Four surveys were conducted in different seasons from 2008 to 2009, to assess the distribution and prevalence of the coconut mite and its damage as well as the presence of natural enemies.

In Iran, **Feng *et al.* (2013)** indicated that, four eriophyid mites, including two new species, *Aceria heteropappi* sp. nov., on *Heteropappus altaicus* (Willd.) Novopokr. (Asteraceae), *Tetra heliotropii* sp. nov. on *Heliotropium chorassanicum* Bung (Boraginaceae); and new records *Aceria malherbae* Nuzzaci on *Convolvulus repens* L. (Convolvulaceae), and *Aceria salsolae* deLillo & Sobhian on *Salsola dendroides* Pall.

In southern Australia, **McCarren and Scott (2013)** assessed eriophyid mite, *Aceria thalgi* Knihinicki as a biological control agent for weeds.

Devi, and Umapathy (2014) studied the biology of the eriophyid mite *Aceria jasmine* Chan., *Aceria mangiferae* (Sayed) and *Aceria mori* Keifer were during 2013.

In Poland, **Lewandowski (2014)** recorded *Aceria alba* Halawa, *A. concolor* Nutt and *A. lasiocarpa* (Hook.) for the first time.

Pilanc *et al.* (2014) recorded two species, *Aceria oleae* (Nalepa) and *Tegolophus hassani* (Keifer) previously recorded in Cyprus, on olive trees for the first time during the surveys in 32 different localities in July 2011 and in January 2013.

Elhalawany and Ueckermann (2015) described four *Aceria* species of eriophyoid mites in Egypt. *Aceria aegyptiacacia* sp.nov., *A. metwallii* sp. nov., *A.awadi* sp. nov.and *A. saidi* sp. nov. Collected from leaf galls of *Acacia nilotica* (L.) Delile (Leguminosae).

In Egypt, **Halawa (2015)** described and illustrated new species, *Aceria alba* n. sp. (Acari: Prostigmata: Eriophyidae) collected from *Sida alba* L. (Malvaceae) and recorded *Calepitrimerus vitis* (Nalepa) collected from *Vitis vinifera* L. (Vitaceae) for the first time.

In Central Argentina, **Flechtmann *et al.* (2015)** re-described two eriophyid mites (Acari, Prostigmata, Eriophyidae), *Aceria cortii* Amrine & Stasny and *Shevtchenkella baccharis* (Keifer) on *Baccharis salicifolia* (Asteraceae).

Halawa *et al.* (2016) described new species, *Aceria rotundus sp.* Nov, found on *Cyperus rotundus* L. (*Cyperaceae* Juss.) from Sohag province, Egypt.

Lotfollahi *et al.* (2016) described and illustrated two new species *Aceria ulmosimilis* sp.nov as blister making species and *Aculus tetranemus* n. sp. as vagrant species on *Ulmus minor* Mill. (Ulmaceae).

Vishnupriya *et al.* (2016) recorded the Jasmine blister mite, *Aceria jasmini* Chan. as a serious eriophyid mite infesting jasmine commercially grown in many parts of South India.

Elhalawany, *et al.* (2018) surveyed 16 eriophyoid mite species from eight species of fruit trees among which *A. ficus Cotté* on *Ficus carica* in Egypt**.**

In Korea**, Duck-Oung Jung *et al.* (2019)** identified the zoysiae mite *Aceria zoysiae* which causing a symptom of chlorosis and marginal rolling of the leaves of zoysia grasses within 3 weeks.

In East Iran, **Arash *et al.* (2020)** recorded four new *Aceria* species (Trombidiformes: Eriophyoidea: Eriophyidae), they are *Aceria halothamni* sp. nov. on *Halothamnus auriculus* (Moq.) Botsch. (Amaranthaceae), *Aceria acanthophylli* sp. nov. on *Acanthophyllum sordidum* Bunge ex Boiss. (Caryophyllaceae), *Aceriasamoli* sp. nov. on *Samolus valerandi* L. (Primulaceae), *Aceria aeluropi* sp. nov. on

Aeluropus littoralis (Gouan) Parl. (Poaceae). In addition, *Aceria atriplicis* Wilson & Oldfield, 1966 was also found on *Atriplex leucoclada* Boiss. (Amaranthaceae), which is a new record for Iran. All these species are vagrants and no symptom was observed on their infested plants.

2- Population dynamics of *Aceria ficus* (Cotté) and its predacious mites on two varieties (Sultani and Adsi) of *ficus carica* L. (common fig).

Rasmy and Abou-Awad (1972) recorded many species of predacious mites from fig trees, *Amblyseius swirskii* (Athias Henriot), *Phytoseius plumifer*, (Phytoseiidae); *Agistemus exsertus* Gonzalze (stigmaeidae); *Saniosulus nudus* summers (Eupalopsellidae), Cheyletogenus *ornatus* (C&F) (Cheyletidae) *Hemisarcoptes malus* Shimer (Hemisarcoplidac) and *Tydeus californicus* Banks (Tydeidae). The phytoseiids particularly *Phytoseius plumifer* was the most commonly encountere d predator.

Heikal (1977) collected the phytoseiid mites *A. swirskii* (Athias-Henriot) and *A. gossipii* El. Badry on most deciduous fruit trees in upper and lower Egypt, *P. plumier* (C. & F.) on fig trees in Alexandria, Fayoum, Burg El Arab and Giza, and the Stigmaeidae mite *A. exsertus* Gonzalez on most deciduous fruit trees, and the Cheyletidae mite *Cheletogenus ornatus* (Canestrini & Fanzago) on almond and apple in upper and lower Egypt, and the *Eupalopsellus olearius* Gomaa (Eupalopasellidae) on apple, quince, almond and grape in Lower Egypt associated with scale insects.

El-Adel (1982) surveyed *E. ficus* on fig (*Ficus carica* L.) trees. He also observed that this species was infested fruits, buds and new & old leaves with high number in Alexandria and Al-Qalubiya governorates.

He also collected *Rhyncaphytoptus ficifoliae* Keifer from fig trees and *Diptilomious ficus* Attiah from sycamore trees.

El-Halawany *et al.* (1986) recorded *Rhyncaphytoptus ficifoliae* and *E. Ficus* on fig trees in Alexandria govemorate. They also found that *E. ficus* infested lower leaf surface, buds, fruits, preferring the new leaves.

Ramaraju *et al.* (2002) indicated that, the population dynamics of *A. guerreronis* Keifer in Tamil Nadu, India, with no clear relationship between mite population and weather factors. Two species of predatory mites viz., Amblyseius (Neoseiulus) paspalivorus and a tarsonemid mite were found inhabiting the perianth region. These mites were observed in very low population inside the perianth and the preliminary observations indicate that they do not cause any significant reduction in the population of the eriophyid mite.

In India, **Beevi *et al.* (2004)** reported three species of phytoseiid mites; *i.e .Amblyseius largoensis* (Muma), *Amblyseiulella nucifera* (Gupta) and *A. alstoniae* were feeding on the contents of the eggs, nymphs and adults of *A. guerreronis Gupta* as predators during survey in Kerala.

Sujatha and Rao (2004) showed that, the population dynamic decrease in mite population per unit area during 2001-02 in Andhra Pradesh. All these were attributed to the role of natural enemies and changes in weather conditions**.**

Thevan *et al.* (2004) studied the effect of phenotypic and biochemical factors on the population and damage caused by *A. guerreronis* and the population of *Amblyseius spp.* He found highly significantly between mite population on the nuts collected from tall palms compared to that of the dwarf palms, moreover, more numbers of predatory mite populations were observed on the elongated nuts than spherical nuts.

The highest number of eriophyid eggs, nymphs and adults were observed on 3-4 months old nuts. Predatory mite population on the young nut was low. However, the population increased with age until 4-5 months with a maximum of 6.9 eggs and 7.4 nymphs and adults on the nut surface. There was a significantly higher population of eriophyid mite on the nut surface/meristematic tissue than on tepal, irrespective of the phenotypic and biochemical factors of palm.

Rao *et al.* (2007) conducted the population buildup of coconut eriophyid mite, *A. guerreronis* and the extent of damage caused by the pest during experiment from February to August 2002.

Desai *et al.* (2009) mentioned that, the infestation of coconut eriophyid mite, *A.guerreronis* Keifer was higher level in Konkan region of Maharashtra, in April and October of 2004 and March 2005 in Thane district followed by Sindhudurg district.

Rajan, *et al.* (2012) indicated that, the *A. guerreronis* incidence in two districts of Andhra Pradesh, India was survey in November 2011 to assess the level of coconut eriophyid mite. East Godavari recorded higher levels of mite incidence, infestation and population in the sampled nuts. Variety-wise mite incidence in the districts revealed highest incidence in the local variety.

Leiva *et al.* (2013) described a new species, *Agistemus aimogastaensis* with the aid of optical and Scanning Electron Microscopy. This mite is an important predator of two eriophyid mites (*Aceria oleae* and *Oxycenus maxwelli)* on olive orchards in La Rioja Province.

In India, **Gurav *et al.* (2015)** demonstrated that, the intensity of various infestation of coconut pests showed the presence of rhinoceros beetles, red palm weevils, black headed caterpillars and eriophyid mites as the most important pests of coconuts in the 4 disricts surveyed, with varying levels of infestation.

Halawa *et al.* (2016) illustrated the identification key to two genera (*Aceria* and *Eriophyes*) and 33 species; 30 of them belong to genus *Aceria* and 3 from genus *Eriophyes*. Ten synonyms of mite species and host plant were recorded. A new species, *Aceria rotundus* sp. nov. found on *Cyperus rotundus* L. (*Cyperaceae Juss.*) from Sohag province, Egypt was described.

Devi *et al.* (2021) reported that, the population dynamics of *A. jasmini* were conducted at different temperatures 15, 25, 34.1, 40, 45 °c with relative humidity 55 per cent under the laboratory condition in leaf disc method at Tamil Nadu Agricultural University, Coimbatore. Both high and low temperatures had direct effect on the mortality of the three developmental stages of *A. jasmini*. One hundred percent egg mortality was occurred at 15 °c and 45 °c followed by 94.92 per cent mortality at 40 °c while, the lowest egg mortality of 9.14 per cent was recorded at room temperature (34.1 °c). Absolutely, mortality was lowest at normal room temperature and highest at lower and higher temperatures viz., 15, 40 and 45°c.

3- Population dynamics of *Aceria lycopersici* (Wolffenstein) and its predacious mites on two cultivations of Tomatoes, *Solanum lycopersicum* L.

Dhooria and Bhullar (2003) recorded 20 eriophyid mites through extensive surveys on the occurrence and pest status of eriophyid mites out on different economic plants at different localities of Punjab, India.

Trottin *et al.* (2003) indicated that, the tomato russet mite, *Aculops lycopersici* (Wolffenstein) is an increasingly important pest in France, and the early damage was observed in January and February in heated glasshouse. Therefore, trials to evaluate the effectiveness of commercially available predatory mites, *Neoseiulus californicus* and *N. cucumeris* in greenhouse tomatoes which resulting that the predatory mites were promising to control of *A. lycopersici.*

Rabindra and Janradan (2007) recorded that, the reduction in tomatoes yields were recorded due to damage caused by *A. lycopersici* (Wolffenstein). During 2000 and 2001, pooled mean of yield loss obtained from the early- and late-transplanted crops in the agro-climatic conditions of Varanasi.

Lamb (2009) reported that the tomato erineum mite *A. lycopersici* (Wolffenstein) causes the production of white, hairy patches on stems and leaf stalks, while, the tomato russet mite, *Vasates lycopersici* (Massee) causing stem and leaf bronzing.

Rabindra Prasad and Janardan Singh (2011) revealed that, brinjal was infested with six mite pest species, viz. *Tetranychus urticae*, *T. macfarlanei*, *T. ludeni*, *Brevipalpus phoenicis*, *Polyphagotarsonemus latus* and *Aceria lycopersici*. Out of these mite species, *T. urticae* - appeared as major pest during post-rainy season, as minor pest in rainy season and as mild pest in autumn. *A. lycopersici* appeared in the form of mild to severe pest during spring and as extremely severe pest during summer season. *T. urticae* remained almost absent in presence of heavy incidence of *A. lycopersici* in spring and summer seasons on brinjal. The findings indicated that displacement of *T. urticae* from brinjal by heavy occurrence of *A. lycopersici* on the same host plant indicated the changing scenario of mite pest spectrum on brinjal in the present studies. As such, *T. urticae* remained the major mite pest during post- rainy and autumn and *A. lycopersici* emerged as severe pest during spring and summer season in brinjal agro-ecosystem in the agro-climatic conditions of Varanasi region.

In Saudi Arabia, **Fahad (2011)** surveyed the phytophagous and predacious mites associated with vegetables and he stated that, the eriophyid mite *A. lycopersici* (Wolffenstein) was found on *Solanum melongina* which was grown in all five localities. On the other hand, the predaceous mites included 10 species belonging to six families (Stigmaeidae, Phytoseiidae, Ascidae, Macochelidae, Eupalopsellidae, and Ereyenetidae) and associated with eight plant species.

Maca (2012) identified about 27 species of eriophyoid mites, including *Aceria horrida* (Nal.), *A. lycopersic*i (Wolffenstein) and *Epitrimerus filipendulae* (Liro), from the Czech Republic for the first time in Southern Bohemia**.**

Sauro Simoni (2013) reported that, the spider mites *T. urticae* having a relatively long stylet which is about 130µm in length that can completely penetrate the epidermal cells and feed on photosynthetically-active mesophyll on both upper and lower leaf surfaces.The feeding causes the destruction or disappearance of chloroplasts which then is visible as yellow to clear spots on the leaf surface. On the other hand, the tomato russet mite, *Aculops lycopersici*, having relatively short stylet which is about 7-20µm in length, can reach only the epidermal cells below the cuticle. The probing site of russet mite is characterized by an irregular hole surrounded by cell content exudates. Russet mite does not ingest all the epidermal cell content and therefore the cellular liquid is expelled outside the cell. Contineous feeding by rust mites on epidermal cells causes a strong deformation followed by desiccation of the leaf surface as result of excessive transpiration. After a short feeding time, the glandular trichomes, which are the fundamental defense organs in tomato leaf against herbivores, rapidly develop a brownish discoloration after which they dry out and fall over onto the plant surface. The damage caused by russet mite appears to be more dispersed and always starting next to the leaf veins.

Lokender Kashyap *et al.* (2014) reported that, the seasonal abundance of tomato russet mite, *Aculops lycopersici* (Massee) (Acari: Eriophyidae) was recorded for the first time on tomato, *Solanum lycopersicum* (L.) plants under polyhouse during April-September 2010-2011. *Aculops lycopersici* was found initially on stem portion of plants and gradually attack the aerial parts of tomato. The lower part of stem shows excessive growth of hair, become rusty brown and damage on leaves and fruits were also seen on infested plants. Correlation coefficient (r) between mite and meteorological parameters were studies which had a positive correlation with temperature.

Afsah (2015) surveyed the insect and mite pests on Cape gooseberry plants (*Physalis peruviana* L.) and showed that, *A.lycopersici* proved to be the most abundant species followed by *Bemisiatabaci* and the *Tetranychus spp.* recorded with occurrence percent 87.15, 4.63 and 4.16% from grand mean total, respectively.

Pokle and Shukla (2015) mentioned that the population dynamics of *A.lycopersici* (Acari: Eriophyidae) on tomato under polyhouse conditions showed remains active throughout the crop season under the polyhouse exists between both eggs and mobile stages of russet mite with conditions with the peak activities of egg and mobile stages during 21st SMW (4^{th} week of May). On the other hand, a significant positive correlation average temperature and average relative humidity under polyhouse conditions on tomato. Moreover, the maximum numbers of egg and mobile stages were found on the top leaves canopy of tomato plant followed by middle and bottom canopy under polyhouse conditions.

Pokle and Shukla (2016) reported that, the population of the predatory mite, *Amblyseius. longispinosus* (Evans) recorded significant positive correlation with the egg and mobile stages of *Tetranychus. urticae* Koch and *A. lycopersici* (r=0.515, 0.401, 0.758 & 0.563, respectively). The predatory mite had also significant positive correlation with average temperature (r=0.799) and average relative humidity (r=0.727) of the polyhouse on tomato. Further, the maximum predatory mite, *A. longispinosus* population was recorded on top leaves of tomato followed by middle and bottom.

Bernardus *et al.* (2017) demonstrated that, when feeding from tomato (*Solanum lycopersicum*), the generalist spider mite *T. urticae* induces jasmonate (JA) - and salicylate (SA) regulated defense responses that hamper its performance. The related *T. evansi*, a Solanaceae-specialist, suppresses these defenses, thereby upholding high performance. On a shared leaf, *T. urticae* can be facilitated by *T. evansi*, likely via suppression of defenses by the latter. Yet, when infesting the same plant, *T. evansi* outcompetes *T. urticae*. Recently, we found that *T. evansi* intensifies suppression of defenses l ocally, i.e., at its feeding site, after *T. urticae* mites were introduced onto adjacent leaf tissue. This hyper-suppression is paralleled by an increased oviposition rate of *T. evansi*, probably promoting its competitive population growth. Here we present additional data that not only provide insight into the spatiotemporal dynamics of defense induction and suppression by mites, but that also suggest *T. evansi* to manipulate more than JA and SA defenses alone.

Halawa (2017) reported that, the life history and predation rate of the predatory mite, *Neoseiulus californicus* (McGregor) on fig bud mite, *A. ficus* (Cotté) and fig leaf mite, *Rhyncaphytoptus ficifoliae* Keifer, were studied separately at 25°C and 60–70% R.H. The predatory mite completed its life span when fed on the mentioned mites. The predation rate, life cycle, and oviposition periods varied depending on type of prey. The development was quickest and number of preys consumed was highest when individuals were maintained on A. ficus, compared with R. ficifoliae. The sex ratio (female: male) was slightly lower on A. ficus as prey than on R. ficifoliae where it was 2.0:1 and2.1:0.9, respectively. The average number of eggs/female/days was 2.98 and 1.67 with total average 37.2 and 23.2 eggs on fig bud and fig leaf mites, respectively. The total average of prey consumed by predatory mite were 265.7 & 239.3 and 236.4 & 211 individual for female and male when fed movable stages of A. ficus and R. ficifoliae, respectively.

Vijay Singh and Usha Chauhan (2018) observed the predatory mite *Neoseiulus sp.* association with the infestation of *Tetranychus ludeni* Zacher on tomato. They also recorded the maximum population of *T. ludeni* d u r i n g June month both years with population 2.6±0.58 (2013) & 2.3±0.42 (2014) mites/leaf. *N.* sp. nr. *neoghanii* was observed in June and July month. Population was 0.2±0.2 mites/leaf both years. Populations of *T. ludeni* and *N.* sp. showed a positive correlation with average temperature and negatively correlated with relative humidity. Occurrence of these species on this crop was the first report from this region. The study will be useful in bio control programme in near future.

Juliette Pijnakker *et al.* (2020) indicated that, the tydeoids, *Homeopronematus anconai* (Baker) and *Pronematus ubiquitus* (McGregor) occur naturally on tomato without being entrapped by the tomato trichomes and can reach high densities when suitable pollen is supplied. They can feed on *Aculops lycopersici*, the tomato russet mite (TRM), an eriophyoid that causes severe damage to greenhouse tomato plants. *Homeopronematus anconai* was first tested against TRM in short term greenhouse trials in a curative and preventative way with supplementation of Typha pollen. The species was effective in reducing

TRM damage, in particular when plants were well colonized by the predatory mites before TRM introduction. In a short-term spring trial, it prevented outbreaks of the pest. In a longer trial, the efficacy of H. pronematus and P. ubiquitus on TRM was compared to untreated control plants. TRM was not eradicated by the tydeoids, but the pest was kept for weeks at low levels on plants that were densely colonized by the predatory mites. The evaluation of the two species revealed thus that high level tydeoid colonization can provide tomato plants protection against A. lycopersici or that the symptoms can be postponed and strongly reduced. Possibilities for an adequate preventative biocontrol strategy is discussed.

Nati Weinblum *et al. (*2021) showed that, the tomato plants have evolved broad defense mechanisms regulated by the expression of defense genes, phytohormones, and secondary metabolites present constitutively and/or induced upon infestation.

4- *Aceria spp.* as vectors of plant viruses.

Bradley (1964) and Maramorosch (1964) stated that "Stylet transmission and circulative" transmission were the most recent terms and appear to be prenial upon the old transmission.

Plavise and Milicic (1980) referred that the intracellular changes in trees infected with fig mosaic virus transmissible by the mite *E. ficus* (*A.ficus).*

Toros (1983) referred that the mites are often overlooked as plant virus vectors, and symptoms of virus infection may be mistaken for feeding damage. The results are The results are given from studies on eriophyids indicated that Aceria tulipae (Keifer) can transmit wheat spot mosaic virus, Abacarus hystix (Nal.) ryegrass mosaic virus, A. ficus (Cotté) (E. ficus) fig mosaic virus, Phytoptus insidiosus (Wilson & Kiefer) Peach mosaic virus. Tetranychids, which inject toxic saliva into the plant during feeding, kill the affected cells and are therefore less likely to transmit viruses and only T.urticae Koch has been proved to be a virus vector.

Ozar et al. (1986) recorded that the eriophyid A. ficus (Cotté) was a vector of fig mosaic virus, which was widespread in the region in Turkey.

Naeem and Akhyani (1988) mentioned that the transmission of the yeast, Hanseniaspora vineae to fig by insects was studied in Iran. This pathogen was carried by several species including. Drosophila sp., Zaprionus sp.and Carpophilus freemani.The symptoms of the disease are described as such as T. urticae, A. ficus and Aceria sp.that feed on fig, did not transmit the yeast.

Sanap et al. (1989) stated that the sterility mosaic virus (SMV) is transmitted by eriophyid mite Aceria cajoni.

Conner et al. (1991) mentioned that the wheat curl mite (Eriophyes tulipae Keifer) is the vector of wheat streak mosaic virus (WSMV), which incites wheat Streak mosaic (WSM), a disease that causes serious yield losses in the winter wheat. Several sources of resistance to mite colonization have been identified.

Ueckermann (1991) recorded and described 10 African species of Aceria associated with the plant family Moraceae. These including Aceria ficus an important vector of the fig mosaic virus.

Laffi and Raboni (1994) detected that the eriopyid Eriophyes tulipae (Keifer) effects on leaves, showing damage such as stunting, twisting, curling and yellow-mottling, buds also are damaged by the mites causing drying or decay. The mite can also transmit different virus.

Nitta *et al.* (1995) observed that the trees with mosaic symptoms, in almost all the fig. growing areas of Hiroshima prefecture, were also infested by mite (A. Ficus) Two types of symptoms were distinguished: light chlorotic spotting and mottling (Type A) and extensive chlorosis along the veins, often with leaf malformation (Type B). When mites from trees with both types of symptoms were inoculated on healthy trees. From these and other results it was concluded that type A symptoms result from Fig bud mite infestation, while type B symptoms are induced by a graft-transmissible pathogen, which could also be transmitted by *A. ficus.*

Ishikawa *et al.* (2012) recorded *A. ficus* (Cotté) for the first time in Shimane, Japan that transmit mosaic virus (FMV) in common fig (*Ficus carica*) trees.

Anna Skoracka *et al.* (2018) reported that, the wheat production and sustainability are steadily threatened by pests and pathogens in both wealthy and developing countries. Their review is focused on the wheat curl mite (WCM), *Aceria tosichella*, and its relationship with wheat. WCM is a major pest of wheat and other cereals and a vector of at least four damaging plant viruses (Wheat streak mosaic virus, High plains wheat mosaic virus, Brom streak mosaic virus, and Triticum mosaic virus). The WCM–virus pathosystem causes considerable yield losses worldwide and its severity increases significantly when mixed-virus infections occur. Chemical control strategies are largely ineffective because WCM occupies secluded niches on the plant, e.g., leaf sheaths or curled leaves in the whorl. The challenge of effectively managing this pest–virus complex is exacerbated by the existence of divergent WCM lineages that differ in host-colonization and virus-transmission abilities. We highlight research progress in mite ecology and virus epidemiology that affect management and development of cereal cultivars with WCM- and virus-resistance genes. We also address the challenge of avoiding both agronomically deleterious side effects and selection for field populations of WCM that can overcome these resistance genes. This report integrates the current state of knowledge of WCM–virus-plant interactions and addresses knowledge gaps regarding the mechanisms driving WCM infestation, viral epidemics, and plant responses. We discuss the potential application of molecular methods (e.g., transcriptomics, epigenetics, and whole-genome sequencing) to understand the chemical and cellular interface between the wheat plant and WCM–virus complexes.

Elzbieta Dabrowska *et al.* (2020) demonstrated that, the viruses belonging to genus Allexivirus infest garlic and are spread via propagation material and through a vector, the eriophyid mite Aceria tulipae (Keifer). The research material was garlic bulbs originating from Poland, available commercially on the Polish retail market. They aimed to assess the possibility of transmission of Garlic virus B (GarV-B), Garlic virus C (GarV-C), Garlic virus D (GarV-D) and Garlic virus X (GarV-X) from garlic bulbs to leek plants by its vector,A. tulipae. These allexiviruses were detected in garlic bulbs and in leek leaves on which transferred mites fed. There was a high similarity of the genetic structure in the isolates of GarV-B, GarV-C, GarV-D and GarV-X collected from garlic bulbs and the isolates collected from the leek plants. The results of the study showed for the first time the potential of GarV-B, GarV-C, GarV-D and GarV-X to infect leek plants and constitutes the first attempt to examine the ability of *A. tulipae* to transmit these viruses from garlic to leek.

V-SUMMARY

The genus *Aceria* (Acari: Eriophyidae) is the largest genus represented by more than 900 species world-wide and found on many plant families (Amrine and Stasny, 1994, 1996). In Europe, this genus currently includes approximately 270 described species, mostly being on host plants of several dicotyledonous families (Lillo, 2012 & Abou-Awad, *et al* (2018).

So this study aimed to survey the mite species belonging to genus *Aceria* on plant foliage, fruit, buds, branches,debris and grass of different Fruit orchards and vegetables in Elsharqia and Qalubia governorates. Moreover, the population dynamics of fig bud mites *Aceria ficus* on ficus varieties and *A. lycopersici* on tomatoes were studied in the same governorates mentioned above during two successive years. In addition, the relationship between some Aceria species and viral diseases were studied. The obtained results can be summarized as follows:

A-The survey studying of genus *Aceria* in El-Sharqia and Al-Qalubia governorates:

- **In El- Sharqia governorate:**

The investigation revealed that there are fifteen species belong to genus *Aceria* were recorded in eight districts of El-Sharqia governorate:

1- ***Aceria mangiferae*** recorded on buds of mango trees.

2- ***Aceria ficu*s** recorded on buds and leaves of fig trees.

3- ***Aceria mori*** recorded on buds and leaves of *Morus alba* L. trees.

4- ***Aceria cynodonensi*s** recorded on leaves and buds of Bermuda grass.

5- ***Aceria imperata*** recorded on buds and leaves of Beauv grass,

6- ***Aceria lycopersici*** recorded with few numbers on buds and leaves of tomato.

7-*Aceria neocynarae* recorded on Leaves and buds of Artichoke plant.

8- ***Aceria tulipae*** recorded on leaves and buds of Garlic plants.

9- Aceria ***aegyptiacus*** recorded on Soil and debris of Garlic plants.

10- ***Aceria olive*** recorded on buds and leaves of Olive trees.

11- ***Aceria sheldoni*** recorded on buds of Citrus trees.

12- Aceria daturae recorded on buds of Datura grass.

13- ***Aceria rodundus*** recorded on buds and leaves of Coco grass.

14- ***Aceria alba*** recorded on arrow leaf sidaor perennialsida.

15- ***Aceria oleae*** recorded on Leaves and buds of Olive trees.

- **In Al-Qalubia governorate**

Fourteen species belong to genus *Aceria* were recorded in six districts of Qalubia governorate, listed as follow

1- ***Aceria mangiferae*** recorded on buds of mango trees.

2- ***Aceria ficu*s** recorded on buds and leaves of fig trees.

3- ***Aceria mori*** recorded on buds and leaves of *Morus alba* trees.

4 - ***Aceria cynodonensis*** recorded on leaves and buds and of Bermuda grass.

5- ***Aceria imperata*** recorded on buds and leaves of Beauv grass,

6- ***Aceria lycopersici*** recorded with few numbers on buds and leaves of tomato.

7- ***Aceria neocynarae*** recorded on Leaves and buds of Artichoke plant.

8- ***Aceria tulipae*** recorded on leaves and buds of Garlic plants.

9**-** ***Aceria olive*** recorded on buds and leaves of Olive trees.

10- ***Aceria sheldoni*** **Ewing** recorded on buds of Citrus trees.

11- ***Aceria daturae*** recorded on buds of Datura grass.

12- ***Aceria rodundus*** recorded on buds and leaves of Coco grass.

13- ***Aceria alba*** recorded on arrow leaf sidaor perennials Ida.

14- ***Aceria oleae*** recorded on Leaves and buds of Olive trees.

1- Only one farm from each governorate was chosen, and cultivated with two fig tree varieties (twenty years old) (Sultani, and Adsi) and kept free from any chemical applications. Each variety was represented by 80 trees, which divided into four replicates (20 trees each).

B- Population dynamics studies

1- Population dynamics of the species *Aceria ficus* On Sultani fig variety in EL-Sharqia governorate.

The population dynamics of *A. ficus* on Sultani fig variety in EL-Sharqia governorate has one annual peak of abundance in June and

October on Old and Young leaves, respectively, during two successive years, while the population reached its peak on buds in August & September during two successive years, respectively.

Statistical analysis of the data cleared that, the population density of *A. ficus* was significantly positive correlated with average temperature and relative humidity in the first and second years, on leaves respectively. While negatively correlated with average temperature and relative humidity the first and second years, within in buds respectively.

On Sultani fig variety in Al- Qalubia governorate:

The population reached the peak in June and July on old leaves, while on young leaves which were recorded in October and June, respectively. They recoded high numbers in March in first year, the recorded peak in February in the second year on buds, respectively.

On Adsi fig variety in EL-Sharqia governorate:

The population reached the peak in October and July on old leaves while on young leaves the peak was recorded in July and October, respectively, but in buds *Aceria ficus* has one annual peak of population in March and February in first and second year, respectively.

On Adsi fig variety in Al- Qalubia governorate

Population dynamics of *Aceria ficus* (Cotté) on Adsi fig variety in Al- Qalubia governorate has one annual peak of population in July, on old leaves, while the peak of the population was recorded on young leaves in June and October respectively. In buds the population peak of fig bud mite were recorded in February in two successive years.

2- Population dynamics of the predators which associated with the species *Aceria ficus* in El-Sharqia Governorate.

There are three predatory mite species, *Amblyseius Swirskii*, *Phytoseius finitimus* and *Agistemus exsertus* were associated with fig bud mite, *A. ficus* on two fig tree varieties.

a- On Sultani fig variety

This study provide that the population dynamics of the predacious mites mentioned above have an annual peak in seasonal abundance on Sultani fig variety at El-Sharqia Governorate in December in case of *A. swirskii*, in two successive years, while in case of the predator, the *Phytoseius finitimus,* the peak was recorded in December during two successive years. On the other hand the predator, *Agistemus exsertus,* the population peak was recorded in November during two successive years.

b - On Adsi fig variety

The population dynamics of the predacious mites mentioned above have an annual peak in seasonal abundance on Adsi fig variety at El-Sharqia governorate in November during *two* successive years.

3- Population dynamics of the predators which associated with the species *Aceria ficus* in Al-Qalubia governorate.

a - On Sultani fig variety

The population dynamics of the predacious mites have one annual peak in seasonal abundance on Sultani fig variety at Al-Qalubia governorate in November in case of the predators, *A. swirskii* and *Phytoseius finitimus,* during two successive years on the other hand, *the predator, Agistemus exsertus,* the population peak was recorded in November and October in the first and second year, respectively.

b - On Adsi fig variety

The population dynamics of the predacious mites have one annual peak in seasonal abundance on Adsi fig variety at Al-Qalubia governorate in December in case of the predators, *A. swirskii* and *Phytoseius finitimus,* during two successive years on the other hand, *the predator, Agistemus exsertus,* the population peak was recorded in November during two successive years.

4 - Population dynamic of *Aceria lycopersici* in El-Sharqia governorate on tomato leaves and buds.

The population dynamics of *A. lycopersici* on leaves has one peak in December and November, in the first and second year, respectively, in buds, the population dynamics of *A. lycopersici* has one peak in January during two successive years. While In Summer plantation the population dynamics of *A. lycopersici* on leaves and buds has one peak in June during two successive years. Finally, fall plantation, the population dynamics of *A. lycopersici* on leaves has one peak in November and October during the first and second year, respectively. the population dynamics of *A. lycopersici* in bud has one peak in September and October during the first and second year.

5 - Population dynamic of *Aceria lycopersici* in Al-Qalubia governorate on tomato leaves and buds.

The population dynamics of *A. lycopersici* on leaves has one peak in December, during two successive years year, respectively, in buds, the population dynamics of *A. lycopersici* has one peak in November and January in the first and second year, respectively While In Summer plantation the population dynamics of *A. lycopersici* on leaves and buds has one peak in June during two successive years. Finally, fall plantation, the population dynamics of *A. lycopersici* on leaves and buds, has one peak in November and October during the first and second year, respectively.

C- The relationship between *Aceria spp. Aceria ficus*; *A. lycopersici A. tulipae* and viral diseases.

The mites were allowed to feed on diseased fig leaves, then they were transferred to healthy seedlings. Also, the fig bud mite, *A. ficus* succeeded to transmit the virus from diseased to healthy plants. In addition the symptoms of virus appeared after an incubation period of 40-45 days. Spots on of Fig leaves may is caused by feeding of mites on the recent leaves. The variety of the fig actually effects on the graft transmissions test, when resulted 70% on Sultani and 60% on Adsi varieties while there is no infection on control plants.

On the other hand, the mites ***A. tulipae*** were allowed to feed on infected wheat leaves, then they were transferred to healthy plants. Symptoms of virus were appeared on inoculated wheat plants after an incubation period of 40-45 days. Infected plants showed chlorotic mottling, mosaic and yellowing of the leaves compared with healthy leaf and the percentage of transmission recorded 60%. No infection was obtained on control plants and for the virus vector. All attempts with *A. lycopersici* were failed to transmit TMV from infected to healthy test plants.