ISSN 1687- 4633

ACARINES

Vol.18, 2024

Complementary description of *Calacarus jasmini* (Phyllocoptinae, Eriophyidae) on jasmine in Egypt, with a special remark to its abundance

Ashraf S. Elhalawany[1*], Ahmad S. Sanad[2] & Rabab A. M. Hammd[3]

[1]*Fruit Trees Mites Department, Plant Protection Research Institute, Agricultural Research Centre, 12611 Dokii, Giza, Egypt; Email: dr_ashraf_said@yahoo.com, ashrafelhalawany@arc.sci.eg; ORCID https://orcid.org/0000-0001-5195-3942*

[2]*Vegetable and Aromatic Plant Mites Department, Plant Protection Research Institute, Agricultural Research Centre, 12611 Dokii, Giza, Egypt, e-mail: a_sanad74@yahoo.com. ORCID ID: https://orcid.org/0000-0002-7561-7916*

[3]*Cotton and Field Crops Mite Department, Plant Protection Research Institute, Agricultural Research Centre, 12611 Dokii, Giza, Egypt, E-mail: drrababhammad@gmail.com*

**Corresponding author:dr_ashraf_said@yahoo.com*

ABSTRACT

The eriophyid mite, *Calacarus jasmini* **rec. Nov.**, associated with *Jasminum grandiflorum*, was recorded for the first time in Egypt during a field survey conducted at Giza governorate from Mar. to Dec. 2023. It caused distortion and spots on the upper leaf surface. A complementary description of this species is given, based on adult females, males, and immature stages. Genus *Calacarus* is a new record for Egyptian mite fauna. A special note was given for its seasonal abundance during the 2023 season. Whereas, *C. jasmini* firstly appeared in early Apr., with moderate numbers, and gradually increased until late Oct. The population reaches its peak in late July. *Tetranychus urticae* has one peak on jasmine leaves in late June. As well as, the predatory mite *Amblyseius swirskii* has one peak in early July. The two mites (*C. jasmin* and *T. urticae*) had a significant positive correlation with and temperature, but no significant negative correlation with relative humidity was observed. The incidence of the two phytophagous mites and *A. swirskii* showed a highly positive relationship. This is the first study on the seasonal abundance of phytophagous mites on jasmine in Egypt.

Keywords: Systematics, Eriophyoidea, ornamentals, new record, ecology.

INTRODUCTION

Jasmine, *Jasminum grandiflorum* L. (Oleaceae), is a scrambling deciduous shrub, native to South Asia, the Arabian peninsula, East and Northeast Africa, and the Yunnan and Sichuan regions of China (Chapman and Wang 2002). It is widely cultivated as an ornamental plant in tropical and temperate regions due to its fragrant blossoms (Addae et al. 2017; Kamala 2020). In Egypt, the flowering season normally starts in Apr., peaks in July, and ends in Sep. (Bera et al. 2015). The blossoms have a strong, lasting scent that is fruity, sweet, and fine, making them useful as absolutes and concretes in perfumery (Edris et al. 2008). Flowers are used as an aphrodisiac, antispasmodic, and antibacterial in folk medicine (Arun et al. 2016). Jasmine provides one of the best consistent return of any crop in Egypt. It is also the second income entry in Egypt's national aromatic raw materials turnover, with $ 6.5 million. All the production is exported, providing the government with steady stream of hard income. Jasmine plantations in Egypt cover an area varying from 262.5 to 350 hectares (Fakhry 2014).

Jasmine is attacked by many pests, including the two-spotted spider mite, *Tetranychus urticae* Koch (Tetranychidae) as a major economic pest, causing excessive damage to the buds and foliage (Maklad et al. 2019; Kamala 2020). Moreover, the two eriophyid mites, *Aceria jasmini* ChannaBasavanna and *Calacarus jasmine* Chakrabarti & Mondal are serious pests in India (Chakrabarti and Mondal 1978; Pirithiraj and Soundararajan 2023).

Eriophyoid mites are very specific to their host plants; around 80% of known species have been reported on a single host species, 95% on a single host genus, and 99% on a single host family (Skoracka et al. 2010). Genus *Calacarus* (Eriophyidae, Phyllocoptinae, Calacarini) was established by Keifer (1940) based on the type

species, *Calacarus pulviferus* Keifer, 1940. Genus *Calacarus* is characterized by body fusiform; prodorsal shield setae *sc* absent, tubercles of *sc* present or absent; gnathosoma quite large projecting obliquely downwards, antapical setae *d* long; legs with all setae, except the genual seta *l''* of leg II missing; with a pattern of curved wax-bearing lines or narrow ridges on opisthosoma; with a central and one or two lateral wax-bearing ridges; the dorsal annuli not much less numerous than the ventral annuli; female genital coverflap with fine obscure scoring (Amrine et al. 2003; Chetverikov et al. 2024b).

Genus *Calacarus* includes 50 species worldwide; only *C. jasmini* has been found on plant species of the family Oleaceae (personal communication with Amrine and de Lillo 2024). *Calacarus jasmini* has been found in Egypt for the first time in the current study. Therefore, the aim of this work is to provide a complementary morphological characterization of this mite species and compare it with the original description; to describe males and immature stages for the first time, along with a remark on the seasonal abundance of jasmine-associated mites in Egypt.

With this study, the Egyptian eriophyoid fauna increased to 130 species in 38 genera (Elhalawany 2022; Elhalawany and Ueckermann 2022; Elhalawany et al. 2019, 2020, 2021, 2022, 2023; Situngu et al. 2023; Chetverikov et al. 2024a).

MATERIAL AND METHODS

Incidence and seasonal abundance of mites

Mite samples were collected from jasmine, at Giza governorate, Egypt during the 2023 season. The area was cultivated by *J. grandiflorum*, as a pesticide-free. Trees are planted at a spacing of 2 x 2 m between rows. Samples of 40 composed leaves were collected biweekly from 20 plants. Leaf samples were packed up into paper bags and brought to the laboratory for direct examination. Phytophagous and predatory mites were recorded using a stereo-microscope (Novex Holland), which was then cleared in Nesbitt solution for about one hr before being mounted on microscope slides in Hoyer's medium (Jeppson et al. 1975). Mounted slides were dried at 45–60°C in an oven (BT5040) for one day. The mites were identified to the species level using a phase contrast (Carl Zeiss, Germany) research microscope, with the help of Zaher (1986) and Seeman and Beard (2011) for Tetranychidae, Abo-Shnaf and Moraes (2014) for Phytoseiidae.

Samples of Eriophyidae were mounted in Keifer's F-medium on microscope slides (Amrine and Manson 1996). Identification to genus level follows Amrine et al. (2003). Morphological nomenclature is based on Lindquist (1996); measurements follow Amrine and Manson (1996) and de Lillo et al. (2010). All measurements are given in micrometers (μm) and refer to length unless specified otherwise. For females, the average measurements are followed by the range values of specimens (n) in parentheses in the description. For males and immatures, only the measurement ranges of "n" specimens are given. Asterisks (*) in descriptions indicate "no variation". All mite specimens were collected by the senior author of this work.

Statistical analysis

The mean number of mites per composed leaf was recorded. The effect of weather factors (e.g., maximum and minimum temperatures and Relative Humidity %) were evaluated as a simple correlation coefficient using Procs Corr, in SAS (SAS institute 2003).

RESULTS AND DISCUSSION

Family Eriophyidae Nalepa, 1898
Subfamily Phyllocoptinae Nalepa, 1892
Tribe Calacarini Amrine & Stasny, 1994
Genus *Calacarus* Keifer, 1940
***Calacarus jasmini* Chakrabarti & Mondal, 1978: 71.**
(Figures 1–3, Table 1)

Female (n=10). Body fusiform, dark brown, 230 (176–260) including gnathosoma, 70 (62–77) wide, at level of setae *c2* and 75 (71–75) thick. **Gnathosoma** 45 (44–47), projecting obliquely downwards, basal setae *ep* 5 (3–5), antapical setae *d* 11 (9–12), palp tarsal setae *v* 2 (1–2), cheliceral stylets 27 (27–31). **Prodorsal shield** subtriangular, 53 (53–61), 62 (53–64) wide; frontal lobe rounded apically and broad basally 11 (9–12). Ornamentation consisting of a complete median

line and admedian lines, sinuate, connected to median line by three diagonal lines forming four closed and open cells, submedian region with five cells on each side of prodorsal shield varying from subrectangular to semicircular; in some specimens these submedian cells can be open or closed. Scapular setae *sc* absent, *sc* tubercles present, rounded, ahead of rear shield margin. **Coxigenital region** with 7 (7–8) incomplete coxigenital annuli between coxae II and epigynium. **Coxisternal plates** with some dashes and granulation; prosternal apodeme 9–11; antero lateral seta on coxisternum I *1b* 16 (13–16), 17 (15–17) apart; proximal seta on coxisternum I *1a* 17 (16–19), 14 (14–15) apart; proximal seta on coxisternum II *2a* 35 (33–37), 35 (33–36) apart. **Leg I** 40 (37–42), femur 13 (12–14), *bv* 16 (15–18); genu 6 (6–8), *l″* 35 (33–40); tibia 9 (8–11), *l′* 7 (7–8) at ⅓ from base; tarsus 8 (7–9); tarsal empodium simple *em* 7 (6–7), 5-rayed, tarsal solenidion *ω* 11 (11–12) with large spherical knob, paraxial fastigial tarsal setae *ft′* 30 (30–32), antaxial fastigial tarsal setae *ft″* 40 (30–41), tarsal setae *u′* 4(3–5). **Leg II** 35 (33–36), femur 13 (11–14), *bv* 13 (11–14); genu 5 (4–7), *l″* absent; tibia 7 (7–9); tarsus 8 (7–9); *em* 7 (6–7), 5-rayed, *ω* 9 (8–10) with large spherical knob, setae *ft′* 16 (12–16), setae *ft″* 30 (27–31), setae *u′* 4 (3–5). **External genitalia.** Genital coverflap posteriorly rounded, with 16 (15–16) longitudinal ridges in a single row at the base, faint, 24 (21–25), 37 (34–37) wide; setae *3a* 14 (12–17), 20 (20–21) apart. **Internal genitalia** spermathecae ovoid, oriented posterolaterad; spermathecal tubes relatively short; transverse genital apodeme trapezoidal, distally folded.

Opisthosoma dorsally with 75 (72–81) annuli, ventrally with 81 (81–85) annuli between posterior margin of coxae II and caudal lobes. Dorsal annuli with five distinct longitudinal waxy ridges that are present from rear margin of prodorsal shield to the posterior at level setae *f*, dorsal annuli smooth, except for posterior-most 12–13 annuli with small irregular round microtubercles. Ventral annuli with minute small, beadlike microtubercles situated on rear margin of each annulus, last nine ventral semiannuli with linear microtubercles. Lateral setae *c2* 47 (37–48), 50 (50–55) apart, on annulus 13 (12–13) from coxae II; ventral setae *d* 57 (43–58), 37 (36–42) apart, on annulus 30 (29–31); ventral setae *e* 50 (35–51), 19 (19–21) apart, on annulus 51 (50–52); ventral setae *f* 28 (25–29), 21 (20–21) apart, on 9–10th annulus from rear. Setae *h1* absent, setae *h2* 65 (45–66).

MALE (*n* = 4). Body fusiform, dark brown, 188–197, 54–74 wide at level of setae *c2*. **Prodorsal shield** subtriangular, 51–55, 60–66 wide, anterior margin of prodorsal shield distinct, broadly rounded. Prodorsal shield pattern, shape, size, and position of tubercles of *sc* as in adult female. **Gnathosoma** projecting downward, palps 40–45; pedipalp coxal seta *ep* 3–5; pedipalp genual seta *d* 9–11; seta *v* 1–2, cheliceral stylets 27–29. **Coxigenital region** with 6–7 incomplete coxigenital annuli between coxae II and epigynium. **Coxisternal plates** with some dashes and granulations; prosternal apodeme 6–7; coxal setae *1b* 12–16, 15–17 apart; *1a* 15–17, 15–17 apart; *2a* 27–34, 30–32 apart. **Genital area** 19–21, 25–27 wide, setae *3a* 10–11, 17–18 apart, *eu* 1*, microtubercles on area between setae *3a*. **Leg I** 36–40, femur 12–13, setae *bv* 14–16; genu 4–5, setae *l″* 30–33; tibia 7–8, setae *l′* 6–7; tarsus 6–7; tarsal empodium *em* simple 5–6, 5-rayed, tarsal solenidion *ω* 8–9 with large spherical knob, setae *ft′* 25–27, setae *ft″* 28–31, setae *u′* 3–4. **Leg II** 32–37, femur 11–12, setae *bv* 11–13; genu 4–5, setae *l″* absent; tibia 7–8; tarsus 6–7; tarsal empodium *em* simple 6–7, 5-rayed, tarsal solenidion *ω* 7–8 with large spherical knob, setae *ft′* 12–15, setae *ft″* 25–30, setae *u′* 3–4. **Opisthosoma** dorsally with 65–72 annuli, ventrally with 75–78 annuli between posterior margin of coxae II and caudal lobes. Dorsal annuli with five distinct longitudinal waxy ridges that are present from rear margin of prodorsal shield to the posterior at level setae *f*, dorsal annuli smooth, except for posterior-most 12–13 annuli with small irregular round microtubercles. Ventral annuli micotuberculated as in adult female. Setae *c2* 27–36, 50–51 apart, on annulus 12–13; setae *d* 38–45, 39–40 apart, on annulus 27–28; setae *e* 33–38, 19–20 apart, on annulus 47–48; setae *f* 27–28, 26–28 apart, on 8–9th annulus from rear. Setae *h1* absent, setae *h2* 45–54.

NYMPH (n=3). Body fusiform, light brown, 147–170 including gnathosoma, 50–55 wide, 55–57 thick. **Gnathosoma** projecting obliquely downwards, 30–36, cheliceral stylets 29–31, setae *ep* 3–4, setae *d* 6–8, palp tarsal setae *v* 1–2. **Prodorsal shield** subtriangular, 35–48, 48–50 wide; frontal lobe rounded apically and broad basally 5–6. Ornamentation consisting of median line absent, complete admedian lines, sinuate, connected to each other at ⅓ and ⅔ by diagonal lines forming U-shape, submedian region with four cells on each side of prodorsal shield, subrectangular. Scapular setae *sc* absent, *sc* tubercles present, rounded, ahead of rear shield margin. **Coxigenital area** smooth; setae *1b* 10–12, 12–13 apart; setae *1a* 8–11, 12–13 apart; setae *2a* 21–23, 26–28 apart; setae *3a* 6–8, 11–12 apart. **Leg I** 27–32, femur 11–12, setae *bv* 11–12; genu 4–5, setae *l″* 25–26; tibia 6–7, setae *l′* 6–7; tarsus 6–7; tarsal empodium *em* simple 5–6, 4-rayed, tarsal solenidion *ω* 6–7 knobbed, setae *ft′* 20–22, setae *ft″* 23–25, setae *u′* 3–4. **Leg II** 21–25, femur 9–10, setae *bv* 11–12; genu 4–5, setae *l″* absent; tibia 5–6; tarsus 5–6; tarsal empodium *em* simple 5–6, 4-rayed, tarsal solenidion *ω* 6–7 knobbed, setae *ft′* 10–12, setae *ft″* 15–18, setae *u′* 3–4. **Opisthosoma** with 58–62 annuli, dorso-ventrally subequal, dorsal annuli forming five longitudinal ridges with wax, smooth, except for posterior-most 10–11 annuli with small irregular round microtubercles, ventral annuli with bead-like microtubercles situated on rear margin of each annulus, elongated and linear on last 5–6 ventral semiannuli. Setae *c2* 25–30, 48–50 apart, on annulus 10 from coxae II; ventral setae *d* 35–40, 44–46 apart, on annulus 22–23; setae *e* 23–26, 26–27 apart, on annulus 35–36; setae *f* 17–19, 36–37 apart, on 6–7th annulus from rear. Setae *h1* absent, setae *h2* 35–39.

LARVA (n=3). Body fusiform, light brown, 128–135 including gnathosoma, 47–50 wide, 52–53 thick. **Gnathosoma** projecting obliquely downwards, 29–32, cheliceral stylets 26–28, setae *ep* 3–4, setae *d* 5–6, palp tarsal setae *v* 1. **Prodorsal shield** subtriangular, 31–33, 40–45 wide; frontal lobe rounded apically and broad basally 3–4. Ornamentation consisting of complete median line forming Y-shape, admedian lines absent, submedian lines forming row of five subrectangular cells subequal in size on each side of prodorsal shield. Scapular setae *sc* absent, *sc* tubercles present, rounded, ahead of rear shield margin. **Coxigenital area** smooth; setae *1b* 9–10, 10–11 apart; setae *1a* 8–10, 10–11 apart; setae *2a* 18–20, 24–25 apart; setae *3a* 3–4, 9–10 apart. **Leg I** 23–24, femur 7–8, setae *bv* 10–11; genu 4–5, setae *l″* 20–21; tibia 5–6, setae *l′* 5; tarsus 5; *em* 4–5, 4-rayed, simple, *ω* 5–6 knobbed, setae *ft′* 17–18, setae *ft″* 20–21, setae *u′* 2–3. **Leg II** 18–19, femur 4–5, setae *bv* 9–10; genu 3–4, setae *l″* absent; tibia 3–4; tarsus 3–4; *em* 4–5, 4-rayed, simple, *ω* 5–6 knobbed, setae *ft′* 10–12, setae *ft″* 20–21, setae *u′* 2–3. **Opisthosoma** with 49–52 annuli, dorso-ventrally subequal, dorsal annuli forming three longitudinal ridges with wax, smooth, except for posterior-most 10–11 annuli with small irregular round microtubercles, ventral annuli with beadlike microtubercles situated on rear margin of each annulus, elongated and linear on last 5–6 ventral semiannuli. Setae *c2* 15–17, 42–45 apart, on annulus 8 from coxae II; ventral setae *d* 20–22, 40–41 apart, on annulus 19–20; setae *e* 14–16, 22–23 apart, on annulus 30–31; setae *f* 17–19, 31–32 apart, on 6–7th annulus from rear. Setae *h1* absent, setae *h2* 25–27.

Host plants in Egypt. *J. grandiflorum*.

Geographical distribution. Bangladesh, India, and Egypt (current study).

Relation to the host plant. Vagrant on upper and lower leaf surface, causing distortion and spots on the upper leaf surface.

Type Locality. India, on *Jasminum sambac* (L.) Aiton (Oleaceae).

Material examined. Twenty females, five males, five nymphs, and five larvae on eight slides (slide no. EGYErio99.1-99.8), from Dokii (30°02'44.98"N, 31°12'24.87"E), Giza governorate, Egypt, 30 Oct. 2021; all deposited in the mite reference collection of Fruit Trees Mites Department, Plant Protection Research Institute, Agricultural Research Centre, Egypt. Four females and one male on two slides (slide no. EGYErio99.9-99.10) with the same previous data, deposited in the mite reference collection of the Egyptian Society of Acarology Museum (ESAM), Zoology and Agricultural Nematology Department, the Faculty of Agriculture, Cairo University, Giza governorate, Egypt.

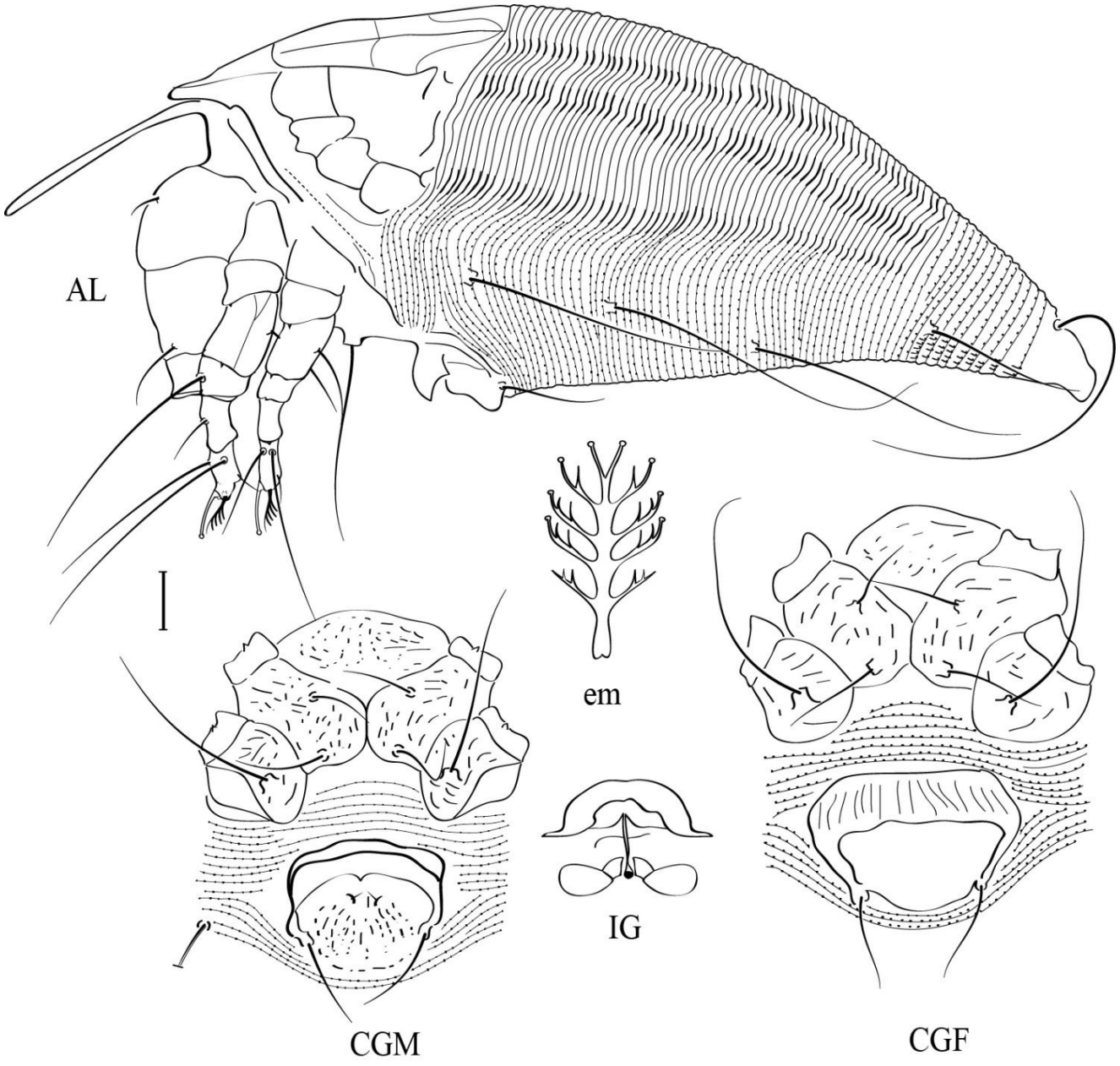

Figure 1. Line drawings of *Calacarus jasmini* Chakrabarti & Mondal adults: AL – Antero-lateral view of mite; CGF – Coxi-genital region of female; CGM – Coxi-genital region of male; em – Empodium; IG – Internal female genitalia; Scale bar: 10 µm for AL, CGF, CGM and IG; 2.5 µm for em.

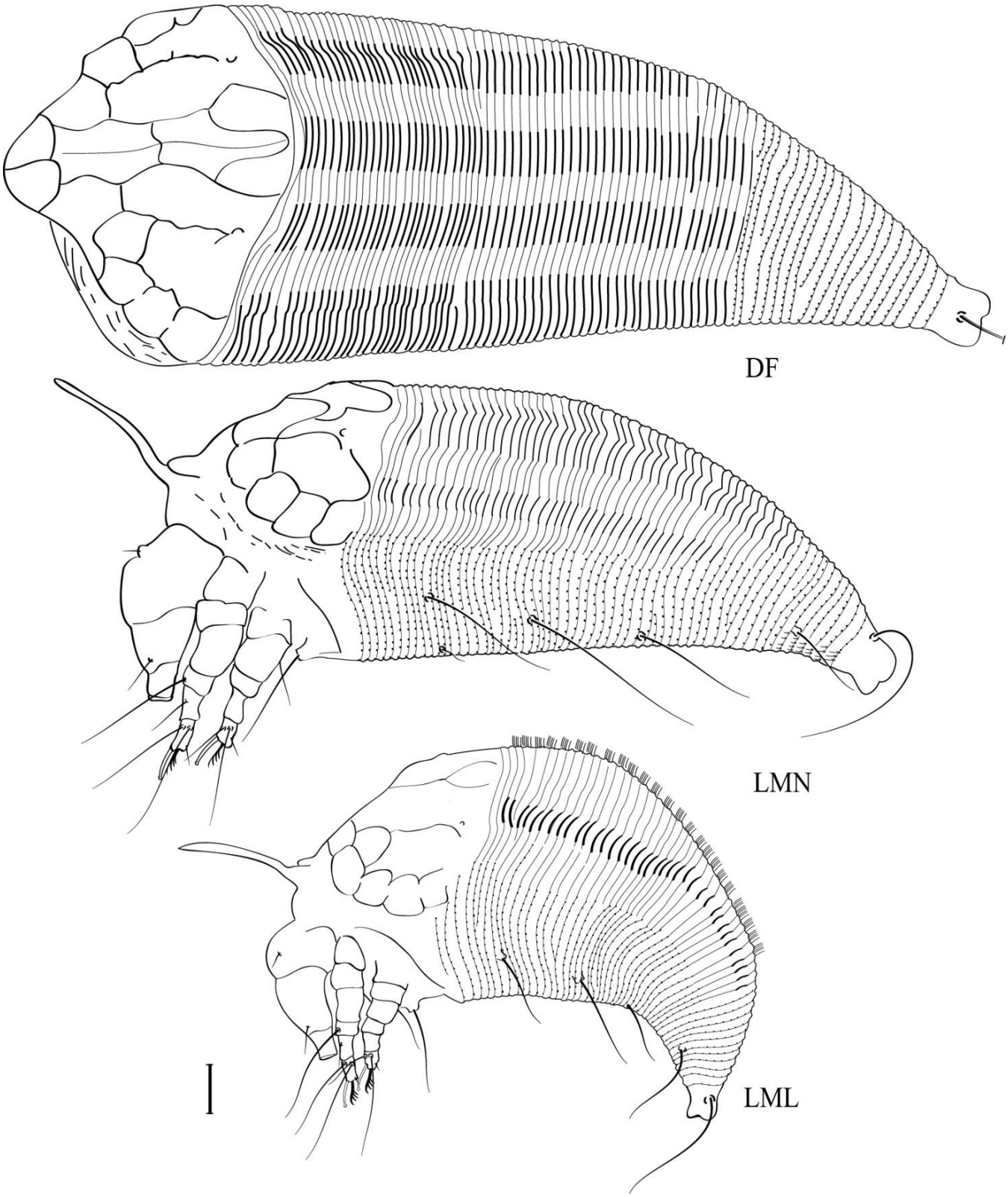

Figure 2. Line drawings of *Calacarus jasmini* Chakrabarti & Mondal: DF– Dorsal view of female; LMN – Lateral view of nymph; LML – Lateral view of larva. Scale bar: 10 µm.

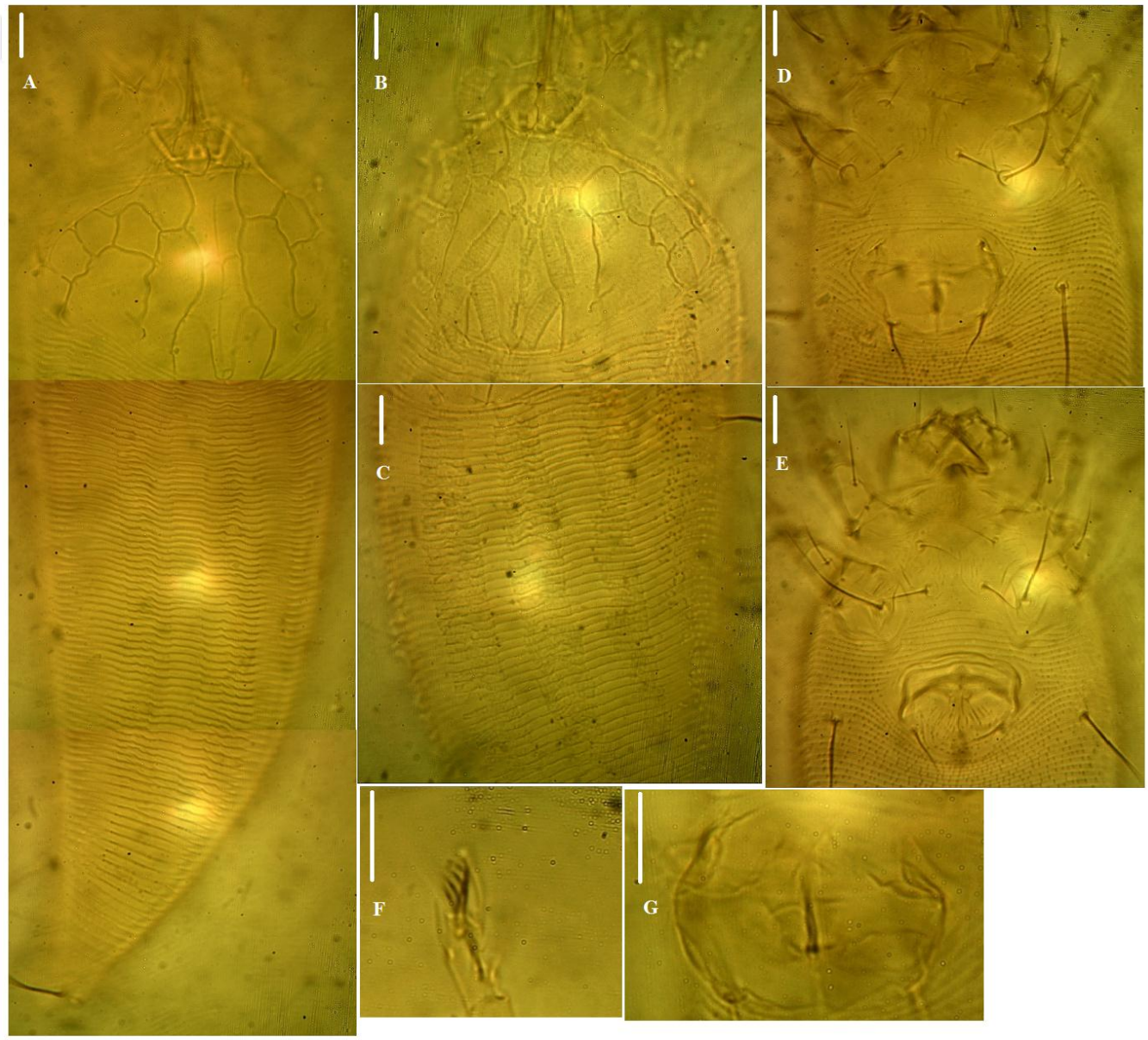

Figure 3. Photographs of *Calacarus jasmini* Chakrabarti & Mondal: A – Dorsal view of female; B – Antero-dorsal view of mite; C – Longitudinal opisthosomal ridges; D – Coxi-genital region of female; E – Coxi-genital region of male; F– Empodium; G – Internal female genitalia. Scale bar: 10 µm.

Remarks

This is the first to record *C. jasmini* females and males in Egypt, as well as the first description of its male and immature stages. Chakrabarti and Mondal (1978) described this species based only on adult females from India. The morphometry of the Egyptian females resembles that of the original description. The number of dorsal and ventral annuli was slightly larger in the Indian specimens than in the Egyptian specimens; and *sc* tubercles were present in the Egyptian specimens but not in the Indian specimens (Table 1). These differences may be attributed to changes in environmental factors (host plant genotype, climatic conditions, and plant physiology) as well as slide preparation technique, operator skills, microscope quality, or the quality of microscopy equipment.

Table 1. Measurements of females of *Calacarus jasmini* associated with *Jasminum grandiflorum* in Egypt and India, the average of the measurement precedes the mite corresponding range for different specimens (given in parentheses).

Characters	*Calacarus jasmini*	
	From Egypt	From India
Body length	230 (176–260)	182.7 (167–245)
Body width	70 (62–77)	80.9 (69.4–89.6)
Gnathosoma length	45 (44–47)	48 (47.6–48.3)
Cheliceral stylets length	27 (27–31)	–
Setae *d* length	11 (9–12)	11.6
Prodorsal shield length	53 (53–61)	57.7 (47.6–63.3)
Prodorsal shield width	62 (53–64)	65.1 (58.8–84)
Leg I length	40 (37–42)	54.6 (50.4–57.8)
Leg II length	35 (33–36)	49.3 (45.1–49.3)
Number of empodial rays	5	5
Setae *3a* length	14 (12–17)	11.6 (11.6–21)
No. of dorsal semiannuli	75 (72–81)	77–98
No. of ventral semiannuli	81 (81–85)	85–113
Setae *c2* length	47 (37–48)	57.7 (35.7–59.9)
Setae *d* length	57 (43–58)	56.7 (41–63)
Setae *e* length	50 (35–51)	54.6 (31.4–54.6)
Setae *f* length	28 (25–29)	31.5 (27.3–36.7)
Setae *h2* length	65 (45–66)	73.5 (41.1–93.5)
Genital coverflap length	24 (21–25)	24.2
Genital coverflap width	37 (34–37)	25.2
Number of longitudinal striae on coverflap	16 (15–16)	15–17

Seasonal abundance of mites on jasmine

Seasonal abundance of *C. jasmini*

Calacarus jasmini was recorded in high numbers on the lower leaf surface of jasmine throughout the 2023 season. It appeared in few numbers on leaves in late Mar. and gradually increased from mid Apr. to early July. It reaches its peak in the 3rd week of July, with 34.72 individuals/composed leaf at maximum and minimum temperature (36.0 and 25.3°C) and 54.4 RH% (Figure 4). These are the first findings for *C. jasmini* based on Egyptian population data. Statistical analysis of the data showed that *C. jasmini* population had a significantly positive correlation with maximum and minimum temperatures (0.82 and 0.75, respectively), but an insignificant negative correlation with relative humidity (-0.42) during the 2023 season (Table 2). These results are consistent with those reported by Haque et al. (1994), who found *C. jasmini* infesting *J. sambac* in northern Bangladesh. This mite causes wrinkling on leaves, affecting plant growth. *Calacarus jasmini* attains its peak throughout Aug.-Sep. Its population is significantly higher on young leaves than on mature and old ones.

Seasonal abundance of *T. urticae*

Tetranychus urticae was found in moderate numbers on the lower leaf surface of jasmine throughout the 2023 season. It appeared in few numbers on leaves in mid-Mar., and its population increased gradually until early June. It reaches its peak in the 3rd week of June, with 7.01 individuals/composed leaf at maximum and minimum temperature (33.3 and 23.5°C) and 49.3 RH% (Figure 4). Generally, during the 2023 season, *T. urticae* disappeared between early Jan. and early Mar. Temperature had a highly significant positive influence on *T. urticae* population (0.89 and 0.82), although relative humidity showed an insignificant negative correlation (-0.56) during the 2023 season (Table 2). This finding was coincided with those obtained

by Neelima (2005) and Shah and Shukla (2014), who indicated that *T. urticae*, peaked from Apr. to July. In India, Pirithiraj and Soundararajan (2023) found that *T. urticae* was occurred in June and Mar., with the lowest incidence in Jan. and May. Kiran et al. (2017) found a highly positive correlation between population density and temperature, but negatively correlated with relative humidity.

Seasonal abundance of the predatory mite, *Amblyseius swirskii* Athias-Henriot (Phytoseiidae)

Amblyseius swirskii is most commonly seen on jasmine leaves. During the 2023 season, *A. swirskii* reaches its peak in early July (3.68 individuals/composed leaf) at maximum and minimum temperature (34.2 and 23.6°C) and 49.9 RH% (Figure 4). According to statistical data analysis from (Table 2), temperature had a significant effect on *A. swirskii* population but not relative humidity. A positive relationship was found between *A. swirskii* and the incidence of the two phytophagous mites, *T. urticae* and *C. jasmini*.

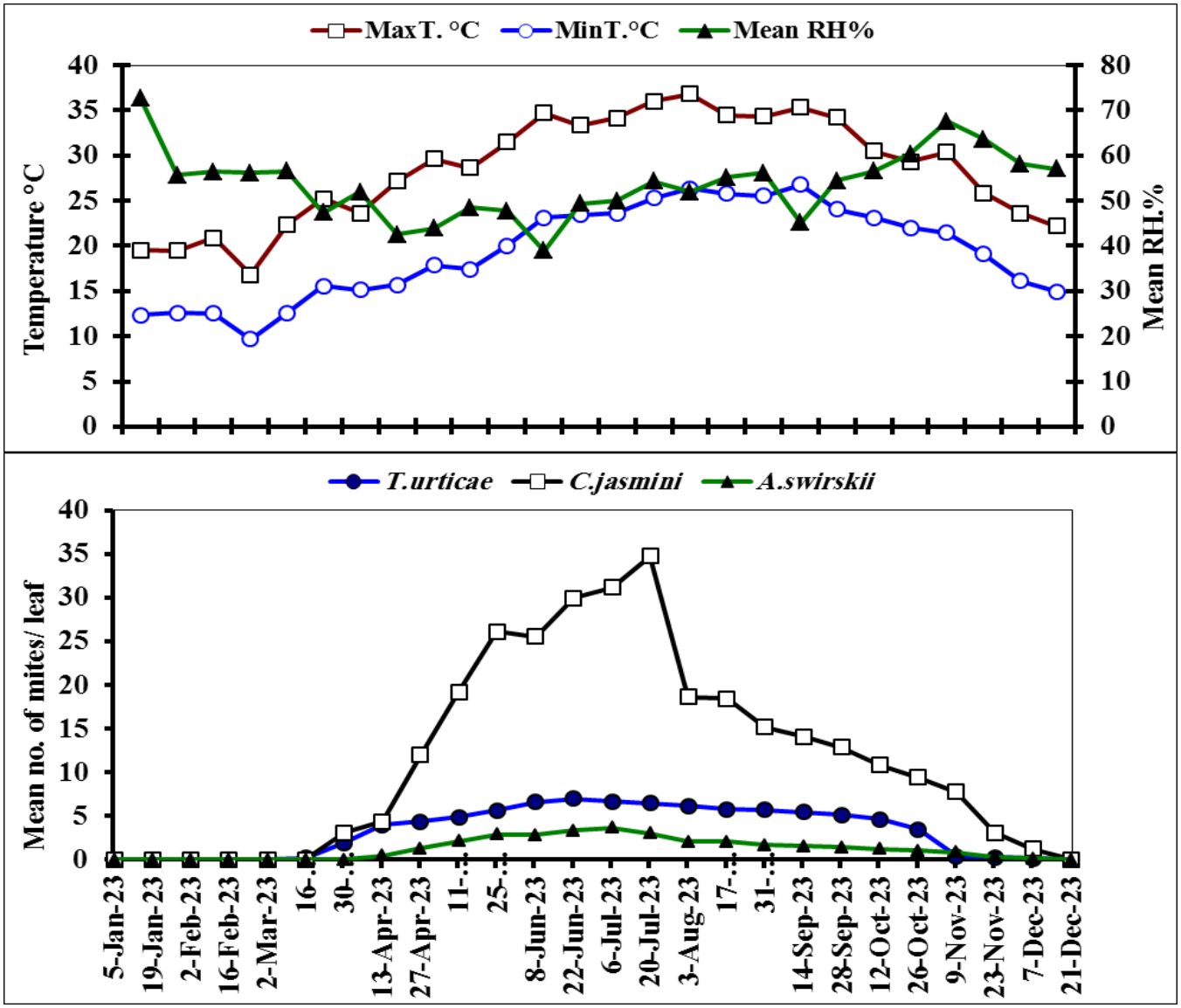

Figure 4. Temperature, relative humidity, and seasonal abundance of phytophagous and predatory mites on jasmine at Giza governorate during the 2023 season**.**

Table 2. Simple correlation coefficient for the effect of weather factors on phytophagous and predatory mites population on jasmine at Giza governorate during the 2023 season.

Mite species	MaxT. °C	MinT.°C	Mean RH%	*A. swirskii*
T. urticae	0.89	0.82	-0.56	0.90
C. jasmini	0.82	0.75	-0.42	0.98
A. swirskii	0.83	0.75	-0.44	–

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