



Research Article

Report of mite, *Sancassania karnatakaensis* (Krishna Rao & Ranganath, 1982) as a potential bioagent of white grub species, *Lepidiota mansueta* Burmeister with taxonomic notes

K. SREEDEVI*, PRATIBHA MENON and SUNIL RATHOD

Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi – 110 012

*Corresponding author E-mail: kolla.sreedevi@gmail.com

ABSTRACT: White grubs are the major pests of several commercial crops viz., groundnut, sugarcane, potato, maize, arecanut, etc. During surveys carried out in sugarcane fields of western Uttar Pradesh for white grub larval collection, it was observed that larvae of *Lepidiota mansueta* Burmeister (Coleoptera: Scarabaeidae) collected from sugarcane fields of Jallopur village, Amroha district, Uttar Pradesh, India exhibited the occurrence of mites on their bodies. The mites were identified as *Tyrophagous putriscentiae*, *Ryzoglyphus* sp. and *Sancassania karnatakaensis*, of which the predominant species was *S. karnatakaensis*. Subsequently studies were conducted to observe the occurrence of *S. karnatakaensis* on reared larvae of five major white grub species viz., *Holotrichia nagpurensis* Khan and Ghai, *Anomala bengalensis* (Blanchard), *Anomala dimidiata* (Hope), *Maladera insanabilis* (Brenske) and *Lepidiota mansueta* Burmeister in the laboratory. The colonization of mite *S. karnatakaensis* was observed on all five species with variations in the percent occurrence. The mite colonization was high in *L. mansueta*, which gradually led to 98% mortality, indicating the potentiality of mite as biocontrol agent.

KEY WORDS: Mite, mortality, *Lepidiota mansueta*, *Sancassania karnatakaensis*, white grub

(Article chronicle: Received: 14-07-2017; Revised: 26-09-2017; Accepted: 30-09-2017)

INTRODUCTION

White grubs are ubiquitous and serious pests of several crops and termed as national pest. These primarily belong to the subfamilies Melolonthinae and Rutelinae of Scarabaeidae (Coleoptera). They are the subterranean pests, where the larvae feed on the roots and rootlets of the crop and lead to drying and subsequent dying of the plants. The white grubs infest sugarcane, maize, groundnut, soybean, potato, turmeric, ginger, arecanut, etc. Their damage is more pronounced in sugarcane crop resulting in huge losses sometimes as high as 80-100% (Chelvi *et al.*, 2011). The management of the white grubs is becoming herculean task due to its subterranean nature and high fecundity.

During the surveys carried out in sugarcane fields at Jallopur village, Amroha district of western Uttar Pradesh, India for the larval collection, it was found that larval bodies were deposited with mites. So, a study has been carried out to assess the efficacy of mites on white grub larvae as a biocontrol agent.

MATERIALS AND METHODS

The larvae of white grubs were collected from the sugarcane fields of Jallopur village, Amroha district (28°54'N; 78°31'E), western Uttar Pradesh, India during 2013-14. The larvae were collected carefully by digging the soil in sugarcane fields. The collected larvae were transferred to plastic jars and brought to the laboratory at Division of Entomology, IARI, New Delhi for further studies. The larvae were reared on potato pieces in the moist soil for taxonomic categorization. Based on the personal studies on larval taxonomic characters coupled with confirmation by mt CO1 molecular characterization, the larvae were identified upto species level and maintained rearing species wise. The grubs of *Lepidiota mansueta* Burmeister, a biennial white grub species was found to be abundant and predominant. The mites present on the larval bodies of white grubs were carefully removed and examined for species identity. Taxonomic studies were carried out on the abundant mite species, *Sancassania karnatakaensis* (Krishna Rao & Ranganath, 1982).

Taxonomic studies

The mites were picked from the body of the grub of *Lepidiota mansueta* Burmeister using a brush under Leica MZ6 stereozoom microscope. The mites were mounted in Hoyer's medium and labeled. After drying on hot plate at 55-60°C for 3-5 days, the slides were observed under Leica DM 2000 phase contrast microscope.

The *S. karnatakaensis* was adequately described by Krishna Rao & Ranganath *et al.* (1982) on *Holotrichia* sp. However, the morphometrics were missing in their descriptions and since the genus *Caloglyphus* was transferred to *Sancassania*, characters that describe them were studied and documented.

All measurements were made from slide-mounted specimens using stage-calibrated ocular micrometers on a phase contrast microscope. Chelicerae were measured from the basal articulations to the tips of movable digits. Idiosomal lengths were measured from the anterior margin to the posterior margin. All measurements are given in micrometers (μm) and denote length unless specified. The terminology follows that of Griffiths *et al.* (1990).

Infestation studies

Later the adults of *S. karnatakaensis* (10 pairs) were released on to the grubs of five major species, *Holotrichia nagspurensis* Khan and Ghai, *Anomala bengalensis* (Blanchard), *Anomala dimidiata* (Hope), *Maladera insanabilis* (Brenske) and *Lepidiota mansueta* Burmeister to observe the colonization and multiplication in the laboratory. The larvae were daily observed for the counts of mites on their bodies till pupation. The percent infestation of mite, *S. karnatakaensis* was calculated. The mortality of grubs was also documented.

Results

The mites extracted from white grub larval bodies collected from Jallopur, Amroha, U.P. revealed three species, *Tyrophagous putrescentiae* (Schrank), *Rhizoglyphus* sp. and *Sancassania* (= *Caloglyphus*) *karnatakaensis* (Krishna Rao and Ranganath, 1982) (Acari: Acaridae). However, the first two species were very less in number and the latter, *S. karnatakaensis* was higher in number ranging from 400 to 1200 per grub of the predominant species, *Lepidiota mansueta* Burmeister.

Taxonomic studies of the mite, *Sancassania karnatakaensis*

The morphometrics of *Sancassania karnatakaensis* is herewith furnished for the first time that adds to the available descriptions.

Redescription of *Sancassania karnatakaensis* (Krishna Rao & Ranganath, 1982)

Body smooth, colourless and shining; appendages pale brown.

Male (homomorphic) (n=10): Length 585 \pm 61 (525-700); width 333 \pm 65 (275-420); chelicerae 133 \pm 21 (100-160).

Dorsum: Propodosomal shield oblong with concave lateral borders; posterior border not distinctly 'M' shaped. All setae smooth, *vi* short, arising midway on the lateral borders of propodosomal shield, Length of dorsal setae: *vi* 62 \pm 7 (50-73), *ve* 9 \pm 3 (7-13), *sce* 227 \pm 57 (140-300), *sci* 43 \pm 11 (30-60), *c*₁ 31 \pm 9 (23-50), *d*₁ 79 \pm 22 (65-125), *e*₁ 147 \pm 44 (100-225), *h*₁ 195 \pm 85 (75-300), *c*₂ 35 \pm 10 (25-50), *cp* 156 \pm 26 (120-200), *d*₂ 44 \pm 10 (33-55), *e*₂ 103 \pm 22 (75-143), *sae* 139 \pm 41 (65-200), *sai* 266 \pm 82 (175-375), supracoxal setae *scx* 7 \pm 3 (5-10), represented by a small thorn like structure.

Venter: *pa*₁ 74 \pm 35 (50-150), *pa*₂ 41 \pm 18 (30-80), *pa*₃ 19 \pm 10 (10-40).

Female (n=10): Length 738 \pm 63 (640-800); width 446 \pm 68 (365-540); chelicerae 156 \pm 7 (150-165).

Dorsum: Propodosomal shield oblong with concave lateral borders; posterior border not distinctly 'M' shaped. All setae smooth, *vi* short, arising midway on the lateral borders of propodosomal shield, *vi* 80 \pm 11 (65-100), *ve* 8 \pm 2 (6-10), *sce* 253 \pm 34 (215-310), *sci* 44 \pm 7 (35-55), *c*₁ 32 \pm 7 (20-40), *d*₁ 79 \pm 25 (40-110), *e*₁ 108 \pm 20 (70-135), *h*₁ 82 \pm 13 (65-100), *c*₂ 40 \pm 8 (25-50), *cp* 181 \pm 19 (150-200), *d*₂ 49 \pm 12 (30-60), *e*₂ 96 \pm 21 (50-125), *sae* 153 \pm 34 (100-200), *sai* 114 \pm 23 (75-140), supracoxal setae *scx* 7 \pm 3 (5-10), represented by a small thorn like structure.

Venter: *pa*₁ 20 \pm 4 (15-25), *pa*₂ 23 \pm 3 (20-25), *pa*₃ 20 \pm 4 (15-25).



Fig. 1. A - *Sancassania karnatakaensis* on *Lepidiota mansueta*, B - mite.

Infestation of *Sancassania karnatakaensis*

Studies on the mite colonization on five white grub species, *Holotrichia nagpurensis* Khan and Ghai, *Anomala bengalensis* (Blanchard), *Anomala dimidiata* (Hope), *Maladera insanabilis* (Brenske) and *Lepidiota mansueta* Burmeister revealed that the mite established on grubs of all five species with varied infestation. The less infestation ranging from 12 to 28% was observed on *H. nagpurensis*, *A. dimidiata*, *M. insanabilis* and *A. bengalensis* while the highest was on *L. mansueta* (95%). The percent mortality was less in *H. nagpurensis* (9%), *A. dimidata* (10%), *M. insanabilis* (11%) and *A. bengalensis* (21%) ranging from 9 to 21% while it was high in *L. mansueta* (98%) (Table 1).

Table 1. Infestation of *Sancassania karnatakensis* on white grub species

White grub species	Per cent infestation	Per cent mortality
<i>Holotrichia nagpurensis</i>	12	09
<i>Anomala dimidata</i>	17	10
<i>Maladera insanabilis</i>	19	11
<i>Anomala bengalensis</i>	28	21
<i>Lepidiota mansueta</i>	92	98

DISCUSSION

Several groups of mites are observed to commonly associate with scarabs, especially species of white grubs belonging to Melolonthinae, Rutelinae and Dynastinae. These can be found associated with the larvae, where they may feed on cuticular exudates or as predators of nematodes or other mites, or fungivores. *Sancassania karnatakaensis* was predominant among the three mite species observed on white grub larvae or grubs in present study. The *T. putrescentiae* and *Rhizoglyphus* sp. are the mould and bulb mites, respectively that dwell in the soil, where former feeds on moulds and latter on bulbs and roots of the plants. Their presence or occurrence on the white grub larvae may be occasional, but the mite *S. karnatakaensis* was found to colonise and multiply on the white grub larva. Most of the species of *Sancassania* (= *Caloglyphus*) are scarab associates mainly phoretic.

The genus *Sancassania* was erected by Oudemans in 1916 with *S. chelone* Oudemans 1916 as its type species. Berlese in 1923, erected the subgenus *Caloglyphus* which was synonymised with *Sancassania* by Samsinak (1960). In 1980, Samsinak based on both adult and hypopial characters revised the tribe Caloglyphini and elevated and re-established the status of *Caloglyphus* to genus. Rao *et al.* (1982) also opined that based on available information it was difficult to co-relate the adult and hypopial

characters at the generic level, hence agreed with Samsinak and deemed it best to merge all genera under *Caloglyphus*. However, Klimov (2000) revised acarid mites of tribe Caloglyphini and synonymized *Caloglyphus* with *Sancassania* and this is currently being followed.

Sancassania is known as a phoretic or saprophage or necrophage of beetles that feeds on dead hosts (O'Connor, 1982), where they attach to an insect, wait until it dies and then consume the dead insect. But in present study, *S. karnatakaensis* was found to associate with the live larvae and complete all developmental stages on the white grub, *L. mansueta* grub. Chmielewski & Lipa. (1967) reported association of *Sancassania* (= *Caloglyphus*) with scarab species. *Sancassania polyphyllae* (Acari: Acaridae) was reported to be associated with larvae of the white grub, *Polyphylla fullo* by Ipek Ekmen *et al.* (2010a) and *S. polyphyllae* was reported to feed on the tissues of *P. fullo* (Ipek Ekmen *et al.*, 2010b). David *et al.* (1986) reported that *Sancassania* sp. were predatory on eggs of the white grub, *Holotrichia serrata* F. causing mortality upto 96 per cent. So, *S. karnatakaensis* as a potent biocontrol agent on *L. mansueta* can be assessed further to contain the white grub species.

The mode of infectivity of mite causing larval mortality has to be ascertained. The proper identification of these mites and their association with white grub species will help us in strategizing the management options. The management of white grub species is becoming extremely tough due to their subterranean nature and also horizontal movement of the grubs. Since *L. mansueta* is a serious pest of sugarcane crop, the mite *S. karnatakensis* can become a potential bioagent for its containment in conjunction with the other compatible methods of management.

ACKNOWLEDGEMENTS

The authors are thankful to Barry M O'Connor, Department of Ecology and Evolutionary Biology, University of Michigan, MI, US for kind help in ascertaining the genus *Sancassania*. Authors thank profusely the Director, Joint Director (Res.), ICAR-Indian Agricultural Research Institute, New Delhi and Head, Division of Entomology, IARI, New Delhi for facilitating the work. Thanks are also due to Dr. V. V. Ramamurthy, Retd. Principal Scientist, Division of Entomology, IARI, New Delhi for the support provided during the study.

REFERENCES

- Chelvi TC, Richard Thilagaraj W, Nalini R. 2011. Field efficacy of formulations of microbial insecticide *Metarhizium anisopliae* (Hypocreales:

- Clavicipitaceae) for the control of sugarcane white grub *Holotrichia serrata* F. (Coleoptera: Scarabaeidae). *J Biopest.* **4**(2): 186–189.
- Chmielewski W, Lipa JJ. 1967. Biological and ecological studies on *Caloglyphus mite* (Acarina: Acaridae) associated with Scarabaeidae. *Acta Parasitologica Polonica* **14**(18): 179–186 + 4 plates.
- David H, Nandagopal V, Ananthanarayana K. 1986. Recent studies on the control of white grub *Holotrichia serrata* Fabr. infesting sugarcane. *J Soil Biol Ecol.* **6**(2): 117–127
- Griffiths DA, Atyeo WT, Norton RA, Lynch CA. 1990. The idiosomal chaetotaxy of astigmatid mites. *J Zool.* **220**: 1–32. Crossref
- Ipek Ekmen Z, Hazir S, Cakmak I, Ozer N, Karagoz M, Kaya HK. 2010a. Potential negative effects on biological control by *Sancassania polyphyllae* (Acari: Acaridae) on an entomopathogenic nematode species. *Biol Control* **54**(3):166–171. Crossref
- Ipek Ekmen Z, Cakmak I, Karagoz M, Hazir S, Ozer N, Kaya HK. 2010b. Food preference of *Sancassania polyphyllae* (Acari: Acaridae): living entomopathogenic nematodes or insect tissues? *Biocontrol Sci Technol.* **20**(6): 553–566. Crossref
- Klimov PB. A review of acarid mites of the tribe Caloglyphini (Acaridae, Acariformes) with description of a new genus and species from Siberia and Russian far east. *Vestnik zoologii* **34**(4-5): 27–35.
- OConnor BM. 1982. Evolutionary ecology of astigmatid mites. *Annu Rev Entomol.* **27**: 385–409. Crossref
- Oudemans AC. 1916. Acari verzamelt bij Bonn. *Entomologische Berichten* **4**: 261–266. Crossref
- Rao NSK, Ranganath HR, ChannaBasavanna GP. 1982. *Caloglyphus karnatakaensis* sp. nov. (Acari: Acaridae) from India, with taxonomic comments on the genus *Caloglyphus*. *Indian J Acarol.* **7**(1): 37–43.
- Samsinak K. 1960. Ueber einige myrmekophile Milben aus der Familie Acaridae. *as. esk Spol Entomol.* **57**: 185–192.
- Samsinak K. 1980. *Caloglyphus rodriguezii* new species with taxonomic remarks on the tribe caloglyphini acari acaridae. *Mitteilungen Aus Dem Zoologischen Museum Berlin*, 201–206