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REDISCOVERY OF *TERMITOLOEMUS MARSHALLI* BARANOV (DIPTERA: CALLIPHORIDAE: BENGALIINAE), A PREDATOR OF TERMITES, AFTER 78 YEARS

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ABSTRACT

Termitoloemus marshalli Baranov (Diptera: Calliphoridae: Bengaliinae) was known to the science only through one male holotype and two female paratypes collected from Kanpur (Uttar Pradesh, INDIA) in 1935. Since then no specimen was ever captured or identified by any worker. In the present paper its rediscovery after 78 years is reported. It was found predating voraciously on the workers and soldiers of the termites *Odontotermes obesus* and *O. giriensis* in Assam and in Dehradun. Material identified is deposited in National Insect Reference Collection, FRI, Dehradun and shall also be deposited with other national and international insect depositories so that the species may be well understood and exploited for termite biological control initiatives.

Key words : Biological control, Termites, *Termitoloemus marshalli*, *Odontotermes obesus*, *Odontotermes giriensis*

Introduction

Termites are widely distributed world over especially in the humid tropics and damage various agricultural and forestry crops, timbers, raw materials of plant origin and other wooden structures. In natural ecosystems, they remove plant organic matter to their underground nests for feeding and growing fungal gardens hence reducing soil fertility by locking them in their nests. They are well known for generating methane, a greenhouse gas, and contributing to climate change.

In India they damage major field crops such as wheat, maize, sugarcane, cotton, groundnut, pulses, and forest plantation trees such as *Eucalyptus*, silver oak, *Casuarina* and various kinds of timber in buildings. Losses due to termites run to several millions of rupees in agricultural crops alone in our country. About 10-25 per cent loss is estimated in most field and forest crops. Severe loss in different regions of India has been recorded on highly susceptible crops such as wheat and sugarcane in northern India, maize, groundnuts, sunflower and sugarcane in southern India, tea in northeastern India and cotton in western India (Rajagopal, 2002). Out of 300 species of termites known so far from India, about 35 species have been reported as damaging agricultural crops and timber in buildings. The majority of the pest species are soil inhabiting, either as mound builders or as subterranean nest builders. The major mound building species are *Odontotermes obesus, O. redemanni* and *O. wallonensis*. The major subterranean species are *Heterotermes indicola, Coptotermes ceylonicus, C. heimi, Odontotermes horni, Microtermes obese, Trinervitermes biformis* and *Microcerotermes beesoni* (Rajagopal, 2002).

Post-harvest loss due to termite activity is common on many small-scale farms. Mitchell (2002) reported that members of the fungus-growing subfamily Macrotermitinae (Termitidae) belonging to genera *Macrotermes, Odontotermes, Pseudacanthotermes, Synacanthotermes, Microtermes, Ancistrotermes* and *Allodontermes* together with *Microcerotermes* (Termitinae) are responsible for the majority of crop damage and 90% of forestry tree mortality in southern Africa. In Brazil Wilcken *et al.* (2002) reported that *Coptotermes testaceus* and other species destroyed eucalyptus heartwood. Plant mortality caused to seedling/sapling by termites vary from10-70 %. Zanetti (2005) reported heartwood volume losses by termites at 0.65 m^3ha^{-1} (1.60%) for *Eucalyptus urophylla* and 0.32 m^3ha^{-1} for *Eucalyptus camaldulensis* (1.17%) in Brazil. In Malaysia subterranean termite control accounted for 50% of the total business turnover of the Malaysian pest control industry in 2000, of which US$ 8-10 million were spent; about 70% of termite treatments were done on residential premises, 20% on industrial buildings and 10% on commercial buildings (Lee, 2002). In USA $ 1.5 billion are spent annually for termite control (Su, 1993). This is only a minuscule insight into the problem; there are no estimates available in the developing and tropical countries where termites are more abundant and widely spread.

Various control measures are utilized world over to control these pests. Chemical treatments in the field and

Termitoloemus marshalli, a diptera predator of termites is rediscovered recently from Assam and Dehradun since its first discovery in 1935.

buildings are easiest and have been most popular with the users. Widespread use of long lasting insecticides in the third world is a great concern to general health of public and native flora and fauna.

Biological control of termites

Biological control refers to the application or manipulation of predators, parasitoids, or pathogens in order to suppress and manage insect populations. Not

Figs 1-6: 1, automontaged photo of a dried male of *Termitoloemus marshalli* Baranov; 2, freshly captured females showing colour variations; 3, soldier of *Odontotermes giriensis* captured by *T. marshalli* flies; 4, *T. marshalli* flies attacking the soldiers and workers of *O giriensis* which came out of damaged mound; 5, *T. marsahalli* flies sitting on the outside of mound of *O giriensis* and attacking the soldiers which peeped out of natural holes in the mound; 6, heaps of dead soldiers and workers of *O. giriensis* killed by the flies, lying along a cracked termite gallery near the base of mound.

much is known about various predators and parasites of termites; therefore, use of pathogens is the most promising area of biological control research with termites. Entomogenous fungi appear to be promising when combined with baiting techniques. In termites social and chemical defenses are strong which limit factors in inhibiting disease outbreaks in the colonies. Fungi and nematodes have received the greatest attention to date. Bacteria are also currently of interest, and manipulation via molecular techniques may be a viable path to development of efficient microbial agents (Grace, 2003).

Grace (2003) accepted that to date very little is known of termite parasitism. The cryptic habits of subterranean termites limit their susceptibility to predators. Ants have been generally considered to be the most effective predators of termites, and under some conditions may be able to exclude them from occupying feeding sites at the soil surface. However, ants are not able to penetrate far into the subterranean gallery system.

Many termitophilous insects especially Staphylinidae (Coleoptera) are known to inhabit termite nests and galleries. Many species of scuttle-flies (Diptera: Phoridae) have been reported to be parasites of termites (Disney, 1986). Logan *et al*. (1990); Grace (1997, 2003); Culliney and Grace (2000) have reviewed extensively literature on the biological control of termites. Grace (2003) concluded that "biological control may yet to supplement, but is unlikely any time soon to supplant, other established subterranean termite control technologies". In all these reviews it is mentioned that none of the predators or parasitic species known so far has been reported to control the termites significantly.

Rediscovery of *Termitoloemus marshalli* Baranov

After thorough review of literature it was found that termite control workers missed an important discovery of a dipteran predator, a new genus *etc.* species *Termitoloemus marshalli* described by Baranov (1936) collected from Kanpur, India, in 1935. English translation of the description is given in Senior-White *et al.* (1940). Though nothing much is known about the behaviour of this fly except described in a line that they are predator of termite workers (Baranov, 1936; Senior-White *et al*., 1940; Beeson, 1941).

In year 1935 (on 3.ii.1935) Mr. H. N. Sharma (After through research on internet it was found that Mr. Sharma was an Entomological Assistant, Pusa. He worked and published on mosquitoes and mealy bugs; see some of his referred work on net like Sharma, 1922; Richards and Sharma, 1934) collected one male and two female specimens of a dipteran fly in Kanpur (Uttar Pradesh) which was found predating the termite workers. Mr. P.B. Richards, ARCS, FES, Entomologist to the Government, United Province, Kanpur (was the founder fellow of National Academy of Sciences, India: http://www.nasi.org.in/founder.htm) sent this material to Imperial Institute of Entomology (now Natural History Museum) London. Director of the Institute Sir Guy A.K. Marshall sent this material to Dr. Von N. Baranov at Zagreb, in the erstwhile Yugoslavakia (now in Croatia). Baranov found this insect belonging to a new genus and named it *Termitoloemus* (on the behavior of fly - predating on termites), and species name *T. marshalli* after Marshall who forwarded the material.

It was strange that this important publication escaped the eyes of biological control workers. This is a monotypic genus which is known only from a male holotype and two female paratypes deposited in the Natural History Museum, London. Since 1935 no specimen of this fly was ever captured and identified and for the reason no entomological collections of the world has its identified specimens. Even in India which is native to the species no identified specimen of the species is present, see catalogue of Calliphoridae by Mitra and Sharma (2010).

In 1998 the author when posted at Rain Forest Research Institute, Jorhat, Assam observed unusual swarming of some dipteran flies over the termite mounds of *Odontotermes obesus*, This species could not be identified at that time due to lack of information to both the taxonomists and biological workers as it had gone deep into the oblivion of the past. As the behavior of the species was unique, therefore, other studies on its biology and bio-control potential was continued in the field. Later in 2007 when the author got transferred to Forest Research Institute, Dehradun again by chance same flies were found swarming on the mounds of another termite species which was identified as *O. giriensis*. Both the Jorhat (Assam) and Dehradun (Uttarakhand) specimens were compared and found to be same species. Search for literature for identification continued until recently when a line about the species *T. marshalli* was seen in the book by Beeson (1941). Automontaged pictures of the species were sent to Dr. Nigel Wyatt Curator - Diptera (Aschiza & Calyptrata), Department of Life Sciences, The Natural History Museum, London. He compared it with the types of *T. marshalli* and suggested to refer Rogens (2011) where Bengaliinae (Calliphoridae) of the world has been reviewed. From the description of species by Baranov (1935), translation in english by Senior-White *et al*., 1940 and pictures of *T. marshalli* in Rogens (2011) species was

identified as the same. Dr. Knut Rognes, University of Stavanger, Norway, also confirmed it the as *T. marshalli*.

In the present paper *Termitoloemus marshalli* Baranov have been rediscovered after almost 78 years (Figs. 1 & 2). Male and females of the species have been photographed to show the morphological details of the species. Photographs were taken with the help of automontage system mounted on Olympus SZX 16 stereo zoom microscope. It is confirmed that they are ferocious predator of *Odontotermes obesus* in Assam and *Odontotermes giriensis* in Dehradun (Figs. 3-6). Taxonomic and biological features of the fly are being dealt in details in a separate paper. Material identified shall be deposited with the national and international insect depositories so that the species may be well understood and exploited for biological control initiatives. It is hoped that this basic information will encourage further studies on various biological aspects of the species, which will be helpful in biological control of termites.

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78 वर्षो बाद दीमक परभक्षी *टर्मीटोलोमस मार्शालाई* वारानोव (डिप्टेरा : केलीफोरीडाई : बंगालीनाई) पर दुबारा की गई खोज

सुधीर सिंह

सारांश

विज्ञान को *टर्मीटोलोमस मार्शालाई* बारानोव (डिप्टेरा : केलीफोरीडाई : बंगालीनाई) के बार में एक नर होलोटाईप तथा दो मादा पाराटाईप्स के बारे में जानकारी थी। जिन्हें 1935 में (उत्तर प्रदेश, भारत) के कानपुर से एकत्रित किया गया था। इसके बाद किसी भी अन्वेषक द्वारा इसके किसी नमूने को चिन्हित नहीं किया गया। प्रस्तुत प्रलेख में 78 वर्षो बाद इस पर पुन: खोज की गई है। इसके सृजकों द्वारा दीमक (*ओडोनोटर्मिस ओबीसस* तथा *ओ. जिरीन्सिस*) को आसाम और देहरादून में तीव्रता से भक्षण करते हुये पाया गया। इस संबंध में प्राप्त सामग्री को राष्ट्रीय कीट संदर्भ संग्रह, वन अनुसंधान संस्थान, देहरादून में रक्षित किया गया है और अन्य राष्ट्रीय तथा अन्तर्राष्ट्रीय की परिरक्षिकाओं में भी रक्षित किया जायेगा ताकि इस प्रजाति के बारे में पूरी जानकारी प्राप्त की जा सके और इसके जरिये दीमक के जीवविज्ञानीय नियंत्रण पर कार्य किया जा सके।

References

Baranov N. (1936). Eine neue Calliphorine-Art (Dipt.), die Termiten angreift. *Annals and Magazine of Natural History,* (10) 17: 646-651.(in German language)

Beeson C.F.C. (1941). *The ecology and control of forest insects of India and neighbouring countries.* Govt. of India Publication ii + 1007 pp.

Culliney T.W. and Grace, J.K. (2000). Prospects for the biological control of subterranean termites (Isoptera: Rhinotermitidae), with special refernce to *Coptotermes formosanus*. *Bulletin of Entomological Research,* 90: 9-21.

Disney R.H.L. (1986). Two remarkable new species of scuttle-fly (diptera: Phoridae) that parasitize termites (Isoptera) in Sulawesi. *Systematic Entomology,* 44: 413-422

Grace J.K. (1997). Biological control strategies for suppression of termites. *Journal of Agricultural Entomology,* 14(3): 281-289.

Grace J.K. (2003). Approaches to Biological Control of Termites. *Sociobiology,* 41 (1A & B): 115-121.

Lee C.Y. (2002). Subterranean Termite Pests and their Control in the Urban Environment in Malaysia. *Sociobiology,* 40(1): 3-9

Logan J.W.M., Cowie R.H. and Wood T.G. (1990). Termite (Isoptera) control in agriculture and forestry by non-chemical menthods: a review. *Bulletin of Entomological Research,* 80: 309-330.

Mitchell J.D. (2002). Termites as Pests of Crops, Forestry, Rangeland and Structures in Southern Africa and Their Control . *Sociobiology,* 40(1): 47-69.

Mitra B. and Sharma R.M. (2010). Checklist of Indian Blow Flies (Insecta: Diptera: Calliphoridae, Rhiniidae). PDF document, 8 pp. Available from: http://zsi.gov.in/checklist/Indian_calliphoridae.pdf

Rajagopal D. 2002. Economically Important Termite Species in India.*Sociobiology,*40(1):33-46.

Richards P.B. and Sharma H.N. (1934). Bull. Dep. Agric. U.P. (Fruit Ser.) no. 33. (http://prr.hec.gov.pk/ Chapters/645S-AL.pdf).

Rognes K. (2011). A review of the monophyly and composition of the Bengaliinae with the description of a new genus and species, and new evidence for the presence of Melanomyinae in the Afrotropical Region (Diptera, Calliphoridae). *Zootaxa*, 2964, 1–60.

Senior-White R.A., Aubertin D. and Smart J. (1940). *The fauna of British India, including the remainder of the Oriental Region*. Diptera. Vol. VI. Calliphoridæ. Taylor & Francis, London, xiii + 288 pp.

Sharma H.N. (1922). A preliminary note on the action of acids, salts and alkalies on the development of culicid eggs and larvae. In *Report of the Proceedings of the Fourth Entomological Meeting* held at Pusa, 7th to 12th February 1921. T. B. Fletcher, Imperial Entomologist, May 5 1922, Calcutta Superintendent Government Printing, India. (http://archive.org/stream/reportofproceedi41921ento/reportofproceedi41921ento_djvu.txt)

Su N.Y. (1993). Managing subterranean termite populations. Pp. 45-50 in Wil;dey, K. B. and Robinson, W. H. (Eds) Proceedings of the 1st International Conference on Insect Pests in the Urban Environment, Cambridge, 30June – 3 July, 1993.

Wilcken C.F., Raetano C.G. and Forti L.C. (2002). Termite Pests in *Eucalyptus* Forests of Brazil. *Sociobiology,* 40(1): 179-190

Zanetti R., Castro R.A., Moraes J.C., Zanuncio J.C., Oliveira A.C. and Dias N. (2005). Estimation of Wood Volume Losses by Heartwood Termites (Insecta: Isoptera) in *Eucalyptus* Plantations in the Brazilian Savannah. *Sociobiology,* 45(3): 619-630.