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Burrowing adaptations and anthropogenic threats of a dune cricket, *Schizodactylus monstrosus* (Drury) : A case study from Champa river bank, West Bengal, India

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Abstract

Schizodactylus monstrosus (Drury) is an Orthoptera belongs to the family Schizodactylidae. Previously although various works has been done on burrowing behavior of the species *Schizodactylus monstrosus*, our investigation unfolds some new facts about their burrowing behavior. Through this paper we also focus on some anthropogenic threats that causes decline in their population vigorously.

Keywords: Adaptation, Champa river bank, cricket, *Schizodactylus monstrosus*.

Introduction

Schizodactylus monstrosus (Drury), commonly known as Dune cricket, Maize cricket, Monster cricket, is an orthoptera belongs to the family Schizodactylidae. As they possesses a pair of long antennae so it looks like moustache for that reason villagers of Rajasthan called it MOOCHHAR. In India *S. monstrosus* is the only representative of this family. Over the world there are only two genera of this insect, the winged *Schizodactylus* from Eurasia and the wingless *Comicus* from Africa. The genus *Schizodactylus* is known from Burma to Turkey including India. Seven species of this genus namely *S. monstrosus* (Drury), *S. inexpectatus* (Werner, 1901), *S. burmanus* (Uvarov, 1935), *S. minor* (Ander, 1938), *S. tuberculatus* (Ander, 1938), *S. hesperus* (Bei Bienko, 1967), *S. brevinotus* (Ingrisch, 2002)

were discovered. Recently the eighth species *S. salweenensis* (Dawwrueng et al., 2018) was discovered from Thailand. In India it is reported from Ajmeer (Khattar, 1972), Jammu and Kashmir (Mukharjee, 1988), West Bengal (Hazra et al., 1983), South India (Fletcher, 1914), Chhattisgarh (Chandra and Gupta, 2005). It is a nocturnal, carnivorous (Khattar, 1972) and also canabolic insect, feeds on ground beetle, grasshopper and other insect and also small frogs. *S. monstrosus* is strictly night active or nocturnal (Khattar, 1972) which is supported by its coloration. The color of the insect is crimish yellow and light green on belly and also on 1st and 2nd pair of leg. Wings are brown. Brown spots are present on head, prothorax and leg. The prothorax exhibits a dark brownish butterfly like design. The

cephalic region contains two large kidney shaped dark brown compound eye and brown antennae with yellow base. *S. monstrosus* complete its life cycle through 9 nymphal stages in more than one year (Khattar, 1972). Nymphal and adult both stages are solitary burrowers.

Sampling site

The investigation was carried out on the cashew garden, 4 km away from Champa river bank, near Barenga village, West Bengal, India. The sand bed consists of light brown, crimson yellow masonry sand or fine sand. Sandy road at the middle of cashew garden consists of small plants and grasses.

Materials and method

S. monstrosus is a burrowing insect. For searching the insect in the burrow Bowerscopy camera is used. For burrow study we used 1:1 solution of Plaster of Paris and water. After pouring the solution in the burrow the insect comes out. So it is easy to collect the specimen without any injury and keep the insect on properly tagged container. After 40 minute from pouring the Paris solution we dig the sand and removed the harden structure from the burrow. We conducted survey regularly among villagers who use to make Amulet with it.

Preservation

We used chloroform to narcotize the insects and 70 percent ethanol is used for the purpose of long term preservation.

Observation

We studied 374 burrows through May 2019 to Feb 2021. Previous records of the deepest burrows are 35.25 ± 8.50 cm (*S. minor*, Channa, 2013), 66.81 ± 7.73 cm (*S. monstrosus*, Channa, 2011) and 160cm (*S.*

inexpectatus, Ayadin, 2005). We measured the deepest burrow is 193cm in depth and burrow of lowest depth is 52cm. Most of the burrow are under the range of 62cm-87cm. The smaller burrow under 75 cm slightly turn to the left in most of the cases. But the longer tunnel (more than 170cm) takes a sudden big turn on the left after 100-120cm. We used 50 adult insect and let them dig for 30 minute to measure the speed of making the tunnel. It dug 76 to 94 cm burrow. There are no side tunnel or brunching. Khattar, 1972 mentioned that the burrows of *S. monstrosus* are closed after they are completed. But observation showed that only in summer the mouth of the burrow remains closed but on other season mostly are open during daytime. Observation also showed the angle of the tunnel varies from season to season. On summer the tunnel formed at an angle of 60degree but in rainy season it formed at an angle of 45degree.

We also noticed their burrowing activity. At first sand are deposited encircling the opening of the newly made burrow but after some time the insect clean the sand from one side of the burrow and deposit in other side of the opening of the tunnel.

S. inexpectatus make the burrows with one small chamber at the end (Ayadin, 2008) but our observation showed that the tunnel of *S. monstrosus* ends without any chamber.

There are mainly 3 types of external burrowing adaptations:

1. Mouth contains large mandible cover with labrum, used for digging out the sand and fore legs with 2 large nails on each, used to grab the sand.
2. It has large, muscular, bushy hind legs consisting of tibia, dorsal spine, apical spurs, triangular plate, euplantulae and nail.

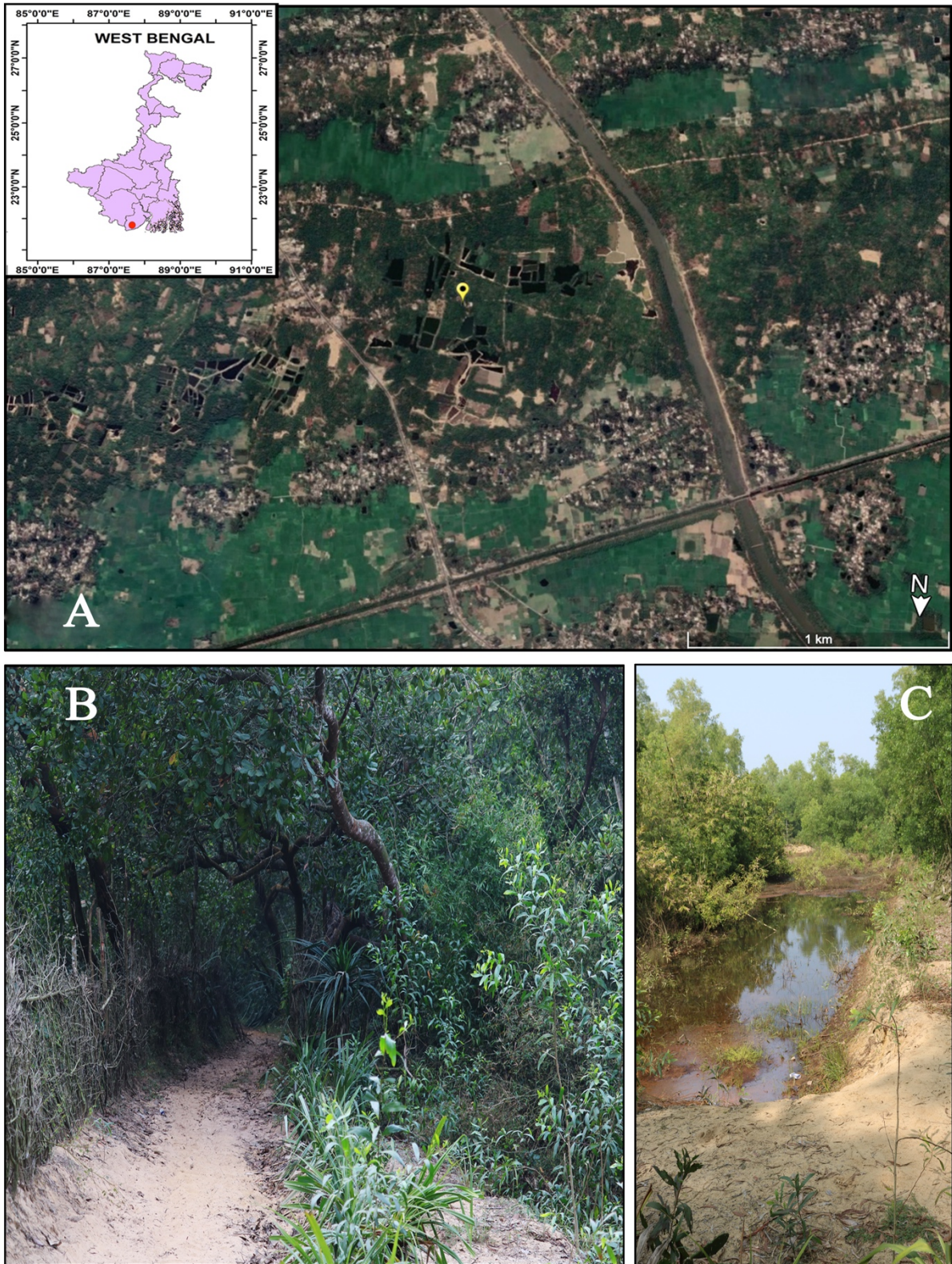


Figure 1(A). G.P.S. location of Study Site, 1(B & 1C). Study Site

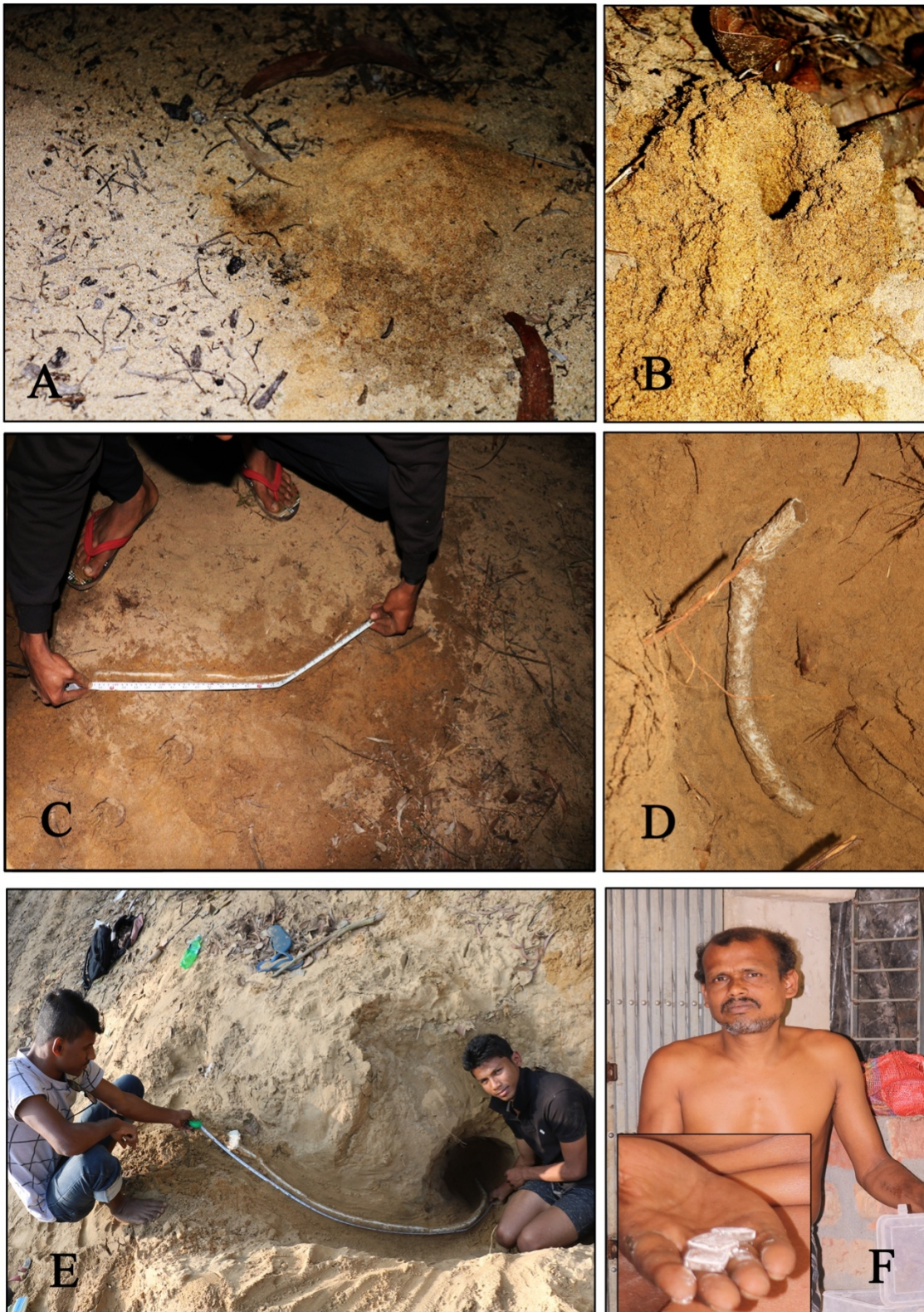


Figure 2(A). Early Made Burrow, 2(B). Freshly Made Burrow, 2(C). Smallest Burrow, 2(D). Solidified Structure of Paris Solution shows actual shape of tunnel, 2(E). Longest Burrow, 2(F). Villagers made Amulet using *S. monstrosus*.

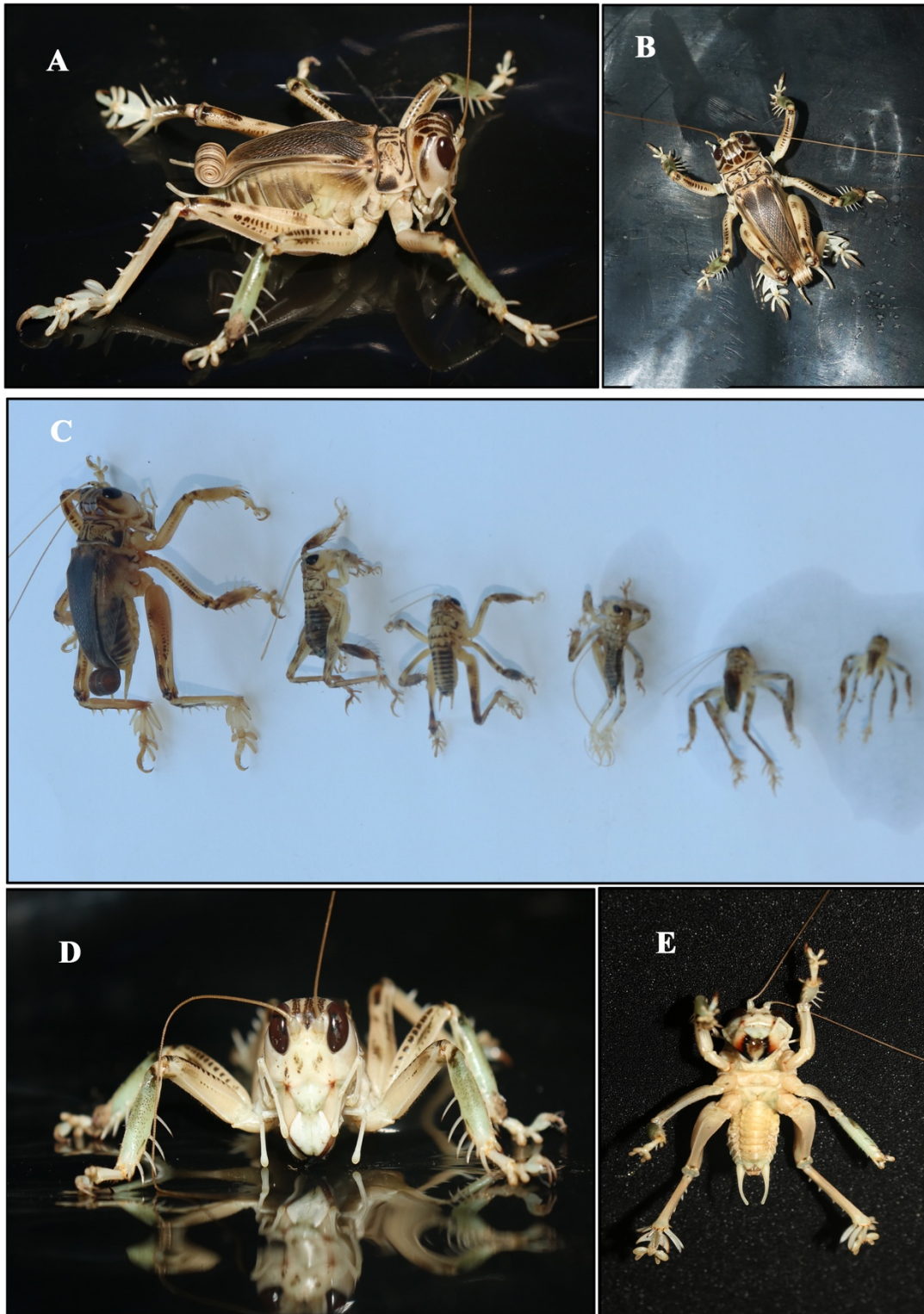


Figure 3(A). Adult *S. monstrosus*, 3(B). Dorsal view of Adult *S. monstrosus*, 3(C). Different nymphal stages of *S. monstrosus*, 3(D). Cephalic of *S. monstrosus*, 3(E). Ventral view of *S. monstrosus*.

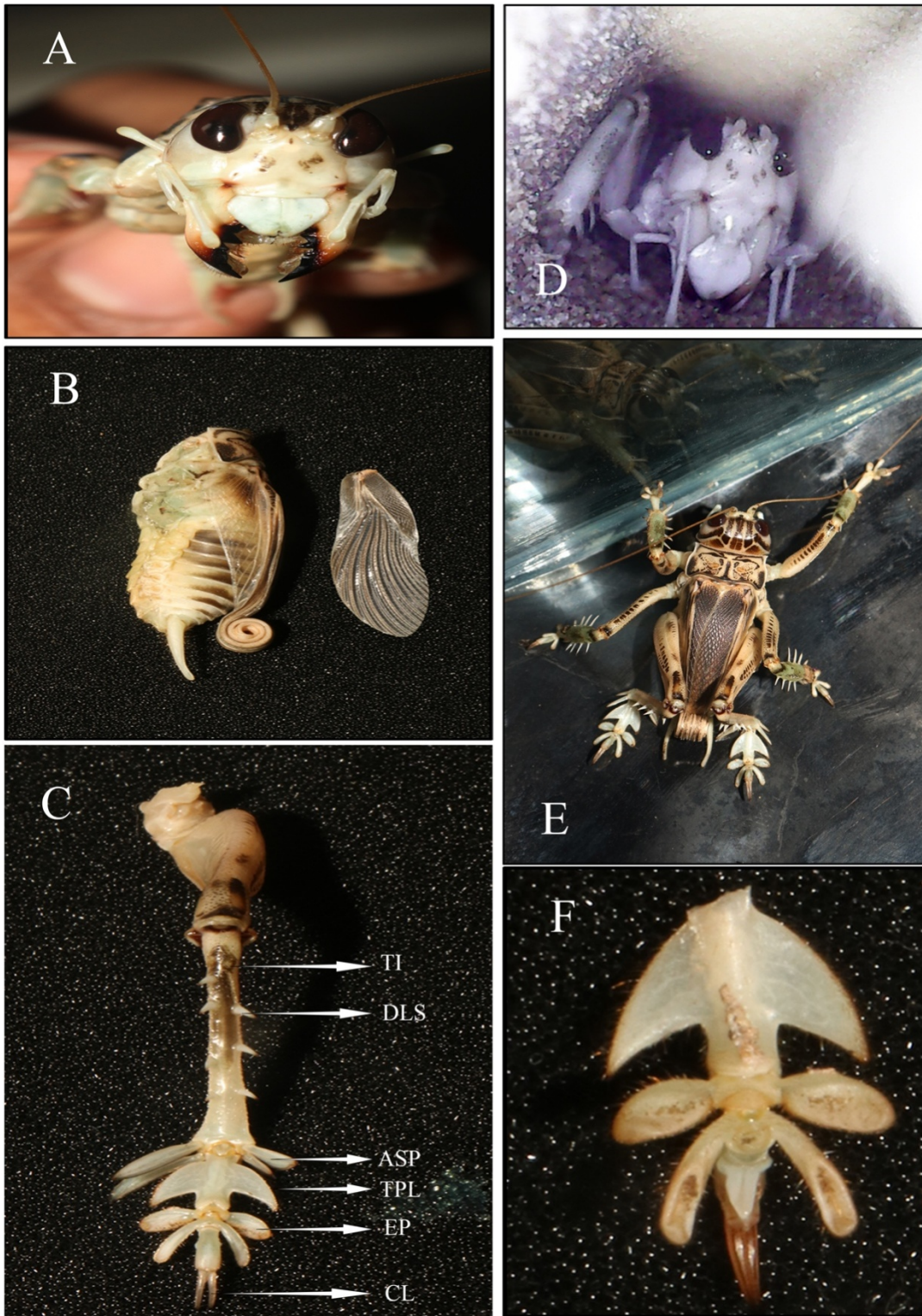


Figure 4(A). Mandible, 4(B). Wing of *S. monstrosus*, 4(C). Hind leg of *S. monstrosus* (dorsal view), 4(D). Specimen in burrow, 4(E). Full grown Specimen, 4(F). Special Structure of hind leg for burrowing. (Abbreviation: TI: Tibia, DLS: Dorsolateral Spines, ASP: Apical spurs, TPL: Triangular plate, EP: Euplantulae, CL: Claw).

Among them apical spurs, triangular plate, euplantulae play a key role in increasing the surface area. For that these insects are medium runners but good hoppers. After digging the sand by mandible, it is pushed out side of the tunnel by its specially modified hind legs.

3. The 9th nymphal stage is the only stage that can fly very less. In adult the posterior part of tegmina typically forms a rolling structure for making a smooth way under the tunnel. We also observed that the adult insects are unable to unfold their wing but we can open it forcefully.

Threats

For the past few decades *S. monstrosus* face a huge risk to survival due to anthropogenic activity. There are traditional beliefs that various parts of their body helps to cure several disease. People of Muslim colony make amulet by using the body parts. Head parts are used for improving intelligence, genital part is used to solve infertility problems, hind legs are used for curing axima in children. Each family of Muslim colony sell approximately 100-150 amulets each month with a price ranging from Rs: 351-551/ amulet. This statistics showed that a huge number of the insects are caught every day. Another threat faced by the species is transportation. As the study site belongs to semi urban area, so large amount of sand transport is carried out for various construction purposes through the cashew garden that is the habitat of the species. Therefore their habitat is disturbed and their number declines at an alarming rate.

Discussion

S. monstrosus is known to make burrow on the soil of high humidity and will dig deeper until they find their desired moisture and humidity of 88.5-98.5 percent (Khattar, 1972). Our study site is 4km away from river bank and soil contains less humidity that forces the species under investigation to make larger burrows.

S. monstrosus enclosed the opening of the tunnel in day time to prevent themselves from sun light. Our study occurs in a cashew garden under the shade of tree for that reason we were unable to found close burrows in day time. During summer it makes burrow at 60 angle to go deeper for searching humidity, but on rainy season when the soil is humid they don't have to go deeper for that it dug burrow at an angle of 45.

As this species is a extreme burrower, it helps in soil aeration. Being a carnivorous animal it feeds on some of the well known agricultural pests and play a key role in food chain.

Now-a-days this species faces a huge threat that leads to increase their extinction rate. So extensive research should be conducted on this topic to monitor the species and to minimize the threats.

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