

Survey, Identification and Biological Studies of Major Insect Pests Attacking Durian (*Durio zibethinus* Murr) in Lanao

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Abstract

The survey was conducted at Matungao Durian Plantation, Sumiorang, Matungao, Lanao del Norte from March, 2002 to December, 2003 with two objectives, namely: to collect and identify the insect pests attacking durian in Lanao and to study the life history of the pest causing the greatest damage on durian.

These insects' fauna consisted of seven orders belonging to 17 families. They were classified as phytophagous, parasitoid, predator, and neutral species. The three insect orders that contained pest species were the Lepidoptera (moths and butterflies), Coleoptera (beetles) and Homoptera (mealybugs).

The seed borer (*Mudaria magniplaga*) is the major insect pest of durian. The minor pests of durian were the fruit borer, *Conogethes punctiferalis* Guenee, the pinhole borer, *Platypus* sp. and the mealybug, *Pseudococcus* sp. Beneficial insects included the coccinellid beetles, *Micraspis* sp., ants, spiders, earwigs and syrpid flies. A braconid wasp, *Asobara* sp. was parasitic on fruit fly maggots which secondarily attack damaged durian fruits.

The total developmental period of *M. magniplaga* ranged from 43-56 days with an average of 49.24 days. The durations of the different life stages were as follows: incubation period, 10-14 days, with an average of 12.00 days; larval stage, from 23-30 days, with an average of 25.92 days; pupal stage, from 10-12 days, with an average of 11.33 days. The adult life span ranged from 9-12 days, with an average of 10.50 days.

Background and Significance of the Study

Durian (*Durio zibethinus* Murr) commonly known as the "king of tropical fruits" is one of the most valued and desired fruits in Southeast Asia (SEA). It is highly priced because of its peculiar taste,

odor and nutritional value. It contains a high amount of energy, total carbohydrates, potassium and vitamins (Evangelista, 1995). The fruit is usually eaten fresh, but is increasingly utilized in home industries for durian candy, jelly and other saleable and profitable products (Coronel, 1983).

In flavor, the durian is considered to surpass all the other fruits in the world. Its popularity is spreading worldwide, resulting in the strong demand for its quality fruit even in Europe and America. This high demand has translated into higher income for durian farmer-producers. According to the country's Department of Science and technology (DOST), the high export potential of durian has made the crop one of the five export winner fruits together with mango, pineapple, papaya and banana.

The fruit, which suitably grows in Lanao, is a very promising alternative source of income for poor farmers. Like other fruits, however, its production is considerably limited by pest infestation. Various studies have documented the insect pests associated with durian production in Southeast Asia, including in some parts of the Philippines, but no such study has been made yet in Lanao.

It is recognized in any pest management program that pests and beneficial species associated with the crop must be known first before they can be managed effectively. At present, there is no information on the proper identity of insect pests that attack durian in Lanao. Such knowledge is vitally needed to develop strategies in controlling these pests in the area effectively.

OBJECTIVES

This study was conducted with the following objectives:

1. collect and identify the major insect pests attacking durian in Lanao, including their natural enemies, and
2. study the life history of the insect pest causing the greatest damage to durian.

MATERIALS AND METHODS

Place and Duration of the Study

Survey and monitoring of insect pests attacking durian were conducted in Matungao Durian Plantation, Sumiorang, Matungao, Lanao del Norte from March, 2002 to December, 2003. Ex-Governor Ali Dimaporo, former governor of Lanao del Sur, owns the 35-hectare farm with more than 1,000 bearing trees.

Collection and Rearing of Durian Insect Pests

Insects and related arthropods were collected by sweeping on vegetation growing around the plantation (Figure 1a), and from damaged leaves, branches and fruits of durian. Collected specimens were then preserved in 80% ethyl alcohol for proper identification.

Infested fruits were collected and brought to the laboratory to allow the emergence of adult pests from their larval stages. Parasitic cocoons present on fruits were collected and observed in the laboratory for possible emergence of parasitoids. Parasitoids that emerged were also preserved for identification. Larvae were reared on durian fruits from several durian trees growing in the vicinity of the College of Agriculture, MSU, Marawi City. These durian fruits were enclosed in mesh nylon bags to prevent the escape of the pests (Fig. 1b).

Identification of the fruit and seed borers was based mainly on the description of Evangelista (1995). Unidentified specimens were sent to the Department of Entomology, Central Mindanao University, Musuan, Bukidnon where they were identified by Dr. Myrna Ballentes, insect taxonomist.



Figure 1. a) Sweeping on surrounding vegetation b) Durian fruits enclosed in nylon mesh bag.

Study on the Seasonal Abundance and Degree of Pest Infestation

Ten durian trees were selected randomly in the plantation. Also, ten randomly selected fruits per tree were examined for pest infestation for

every field survey. Percent infestation per tree was calculated based on unit samples with or without visible damage. Degree of pest infestation for local and improved and/or hybrid varieties were also compared.

Infested fruits were collected and brought to the laboratory. Dissection, identification, counting, and proper listing of insect pests and beneficial arthropods present in the infested fruits were done. Larvae and other immature insects were reared until the adult stage to observe possible emergence of parasitoids. The species that occurred in highest number and caused the greatest damage to durian fruits was ranked the major insect pest.

Life History Study

The life history of the most abundant species causing the greatest damage to durian in the study area was studied both under laboratory and field conditions.

Initial population of the pest was started by intensive collection of larvae and pupae from infested durian fruits. Larvae were artificially infested on durian fruits produced by a tree planted beside the Mushroom Rearing House of the College of Agriculture, MSU, Marawi City. The fruits were enclosed individually with mesh nylon bags to prevent the escape of the pest. Used oil was applied on the receptacles of durian fruits to prevent attack by ants and other predators.

Larvae and pupae were collected from damaged fruits and allowed to emerge as adults under laboratory conditions. After emergence, adults were allowed to mate in a cage. Small-sized fruits were provided as oviposition sites for the females. Cotton balls soaked in honey solution were also provided as source of food for the adults. Newly laid eggs were collected and transferred to petri dishes. Percent hatchability was computed using the formula:

$$\text{Percent Hatchability} = \frac{\text{Total number of hatched eggs}}{\text{Total number of laid eggs}} \times 100\%$$

Twenty newly emerged larvae were reared individually in glass vials. These larvae were provided daily with fresh excised durian fruit until they reach the pupal stage. The duration of the different stages of their

development was recorded. Another twenty newly emerged larvae were reared in groups on durian fruits enclosed in nylon mesh bags. The total development was recorded. Longevity of the adults was also recorded.

RESULTS AND DISCUSSION

Arthropods Associated with Durian

Three classes of arthropods were found associated with durian grown in Matungao Durian Plantation, Sumiorang, Matungao, Lanao del Norte (Table 1). These included Arachnida (spiders), Diplopoda (millipedes), and Insecta (insects). Among the collected arthropods, insects dominated both in numbers and kinds.

Class Arachnida

Spiders were among the arthropods found associated with durian. They are generalist predators and feed on many kinds of insect prey of suitable sizes. One of the species properly identified by was the wolf spider, *Lycosa* sp. (Fig. 2a).

Class Diplopoda

This class of arthropods includes the millipedes or thousand-legged worms. Millipedes are not insects, but are more closely related to lobsters and shrimp. However, unlike their marine cousins, millipedes are land dwellers. They were often found in moist habitats or areas of high humidity.

Millipedes associated with durian were tiny and pale brown. They were collected from decaying fallen durian fruits in the field. According to Ross et al., (1982), most species of millipedes feed on decaying plant materials (Fig.2b).

Class Insecta

The insect's fauna of the studied durian fruits consisted of seven orders belonging to 17 families. Generally, the insect fauna associated with the samples were classified as phytophagous, predators, parasitoids and neutrals.

A. Phytophagous Insects

The three identified insect orders that contained pest species were Lepidoptera (moths and butterflies), Coleoptera (beetles) and Homoptera (mealybugs) (Table 2). The seed borer (*Mudaria magniplaga*), however,

was identified as the major insect pest of durian samples. Visual counts done throughout the survey period consistently showed a high larval population of this pest compared with other pest species (Fig. 3).

Another pest species found to cause damage on durian was the fruit borer (*Conogethes punctiferalis*). This species caused great damage to durian fruits during the first five months of the survey. Later, its population became low and was displaced by the durian seed borer until the end of the survey period. The *Conogethes* sp. adult moth had a yellow color and numerous black spots on its forewings. The larva was slightly reddish with black spots on the dorsal surface of the body (Fig. 4).

The minor pests of durian included the pinhole borer (*Platypus* sp.) and the mealybugs (*Pseudococcus* sp.). The pinhole borer usually attacks trunks of durian trees by making small pinholes. Damage often results in the yellowing of the affected trunk eventually leading to death of the tree (Fig. 5). Mealybugs often attack leaves, flowers and fruits. However, they do not cause serious damage (Fig. 6). Other pests that are noneconomically important are the fruit flies (Tephritidae and Drosophilidae). Injuries caused by the fruit borers and seed borers served as avenues for the attack of these flies.

Table 1. Summary of Classes, Orders and Families of Arthropods Associated with Durian. (Matungao Durian Plantation, Sumiarong, Matungao, Lanao del Norte, March, 2002 – December, 2002)

CLASS/ORDER	FAMILY/GENUS	COMMON NAME
Arachnida	Lycosidae (<i>Lycosa</i> sp.)	spider
Diplopoda	-----	millipede
Insecta	-----	
Coleoptera	Staphylinidae Elateridae Coccinellidae Chrysomelidae Nitidulidae Undetermined family	click beetle ladybird beetle
Dermaptera	Labiduriidae	Earwig
Blattodea	Blatellidae Anaplectidae	Cockroaches
Homoptera	Pseudococcidae	Mealybug

Diptera	Tephphritidae Drosophilidae Syrphidae	fruitfly syrphid fly
Lepidoptera	Pyralidae Noctuidae	fruit borers seed borers
Hymenoptera	Formicidae Barconidae	ants wasps

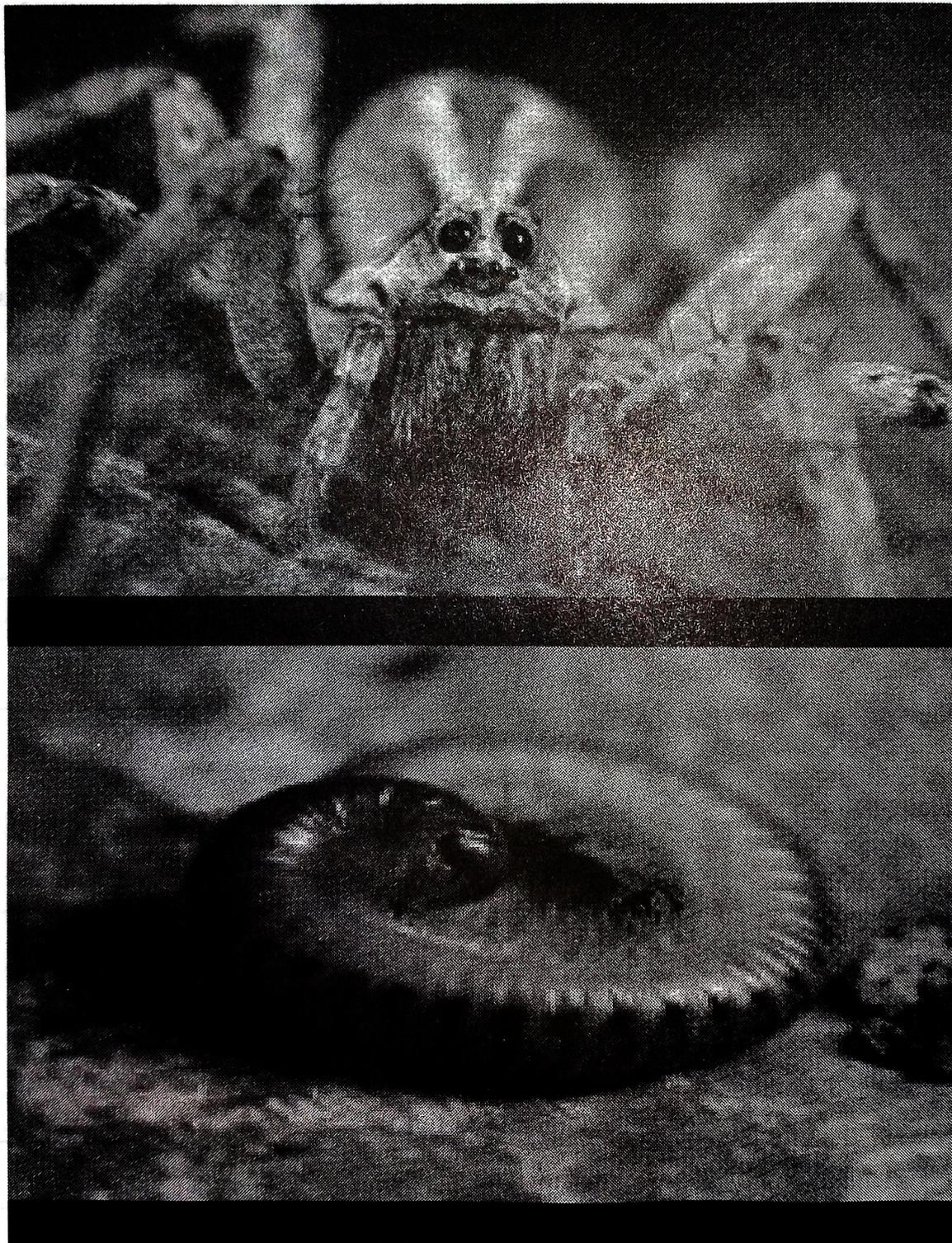


Figure 2. a) adult of *Lycosa* sp. Photograph from website: (www.mamba.bio.uci.edu) b). millipede (www.gardensafari.net)

Table 2. List of economically important insect pests associated with durian in Matungao Durian Plantation, Sumiorang, Matungao, Lanao del Norte.

Order/Family	Species	Common Name
<i>Lepidoptera</i>		
Noctuidae	<u><i>Mudaria magniplaga</i></u>	durian seed borer
Pyralidae	<u><i>Conogethes punctiferalis</i></u>	durian fruit borer
<i>Coleoptera</i>		
	<u><i>Platypus</i> sp.</u>	pinhole borer
<i>Homoptera</i>		
Pseudococcidae	<u><i>Pseudococcus</i> sp.</u>	mealybug

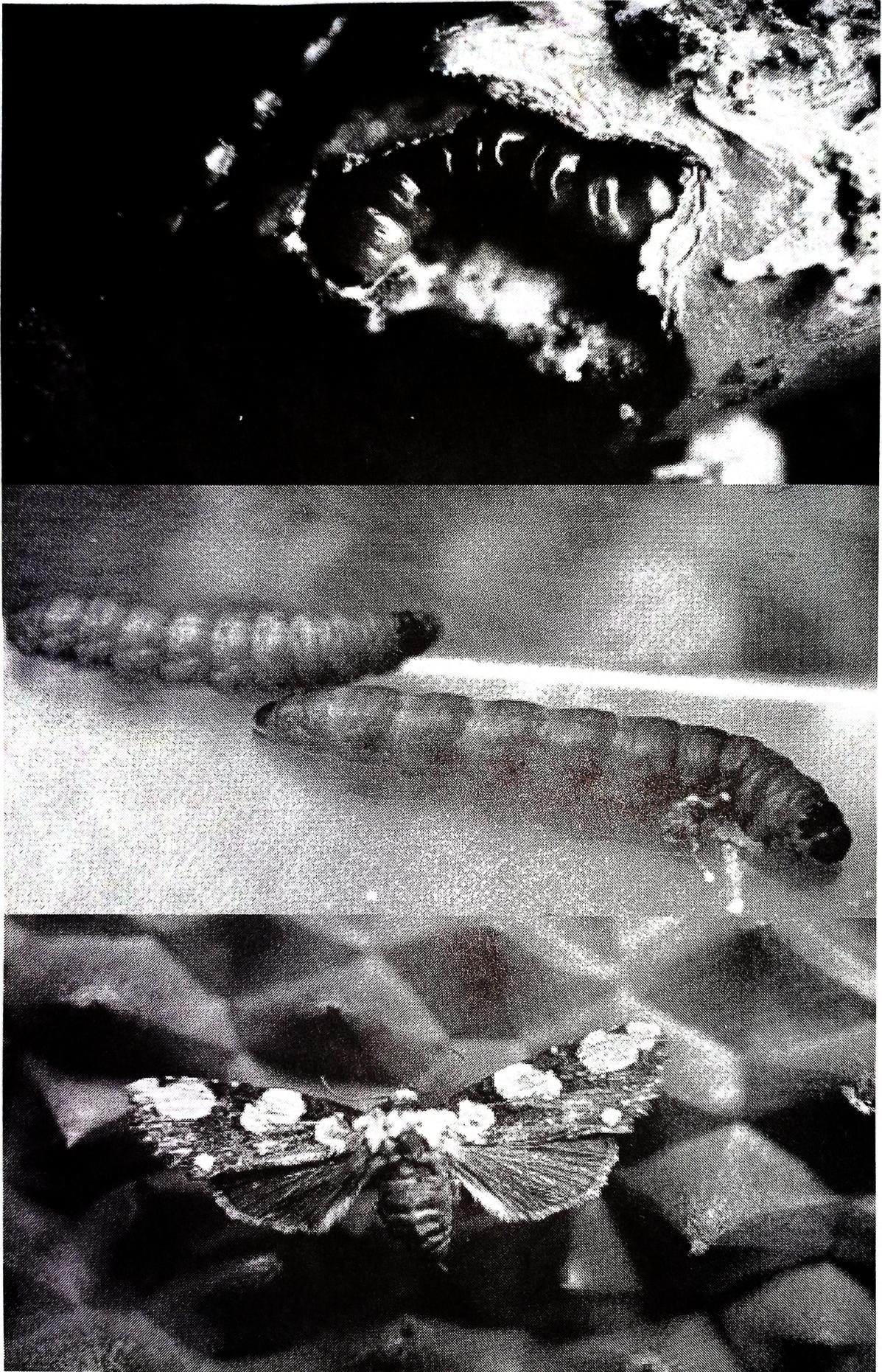


Figure 3. Upper, middle & lower photos: larvae and adult moth of the durian seed borer, *Mudaria magniplaga*. Photographs taken from website: <http://www.ipmthailand.org>

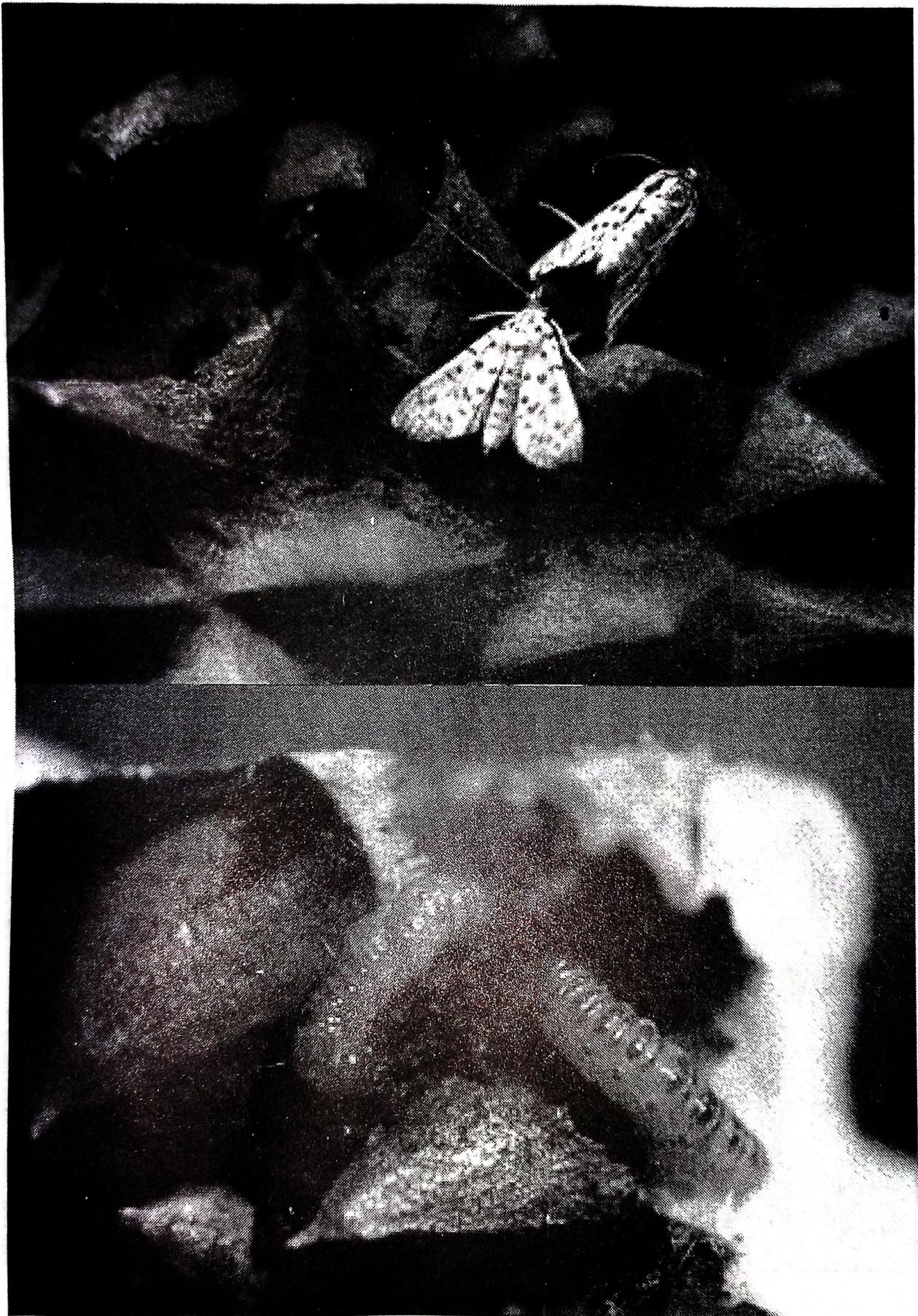
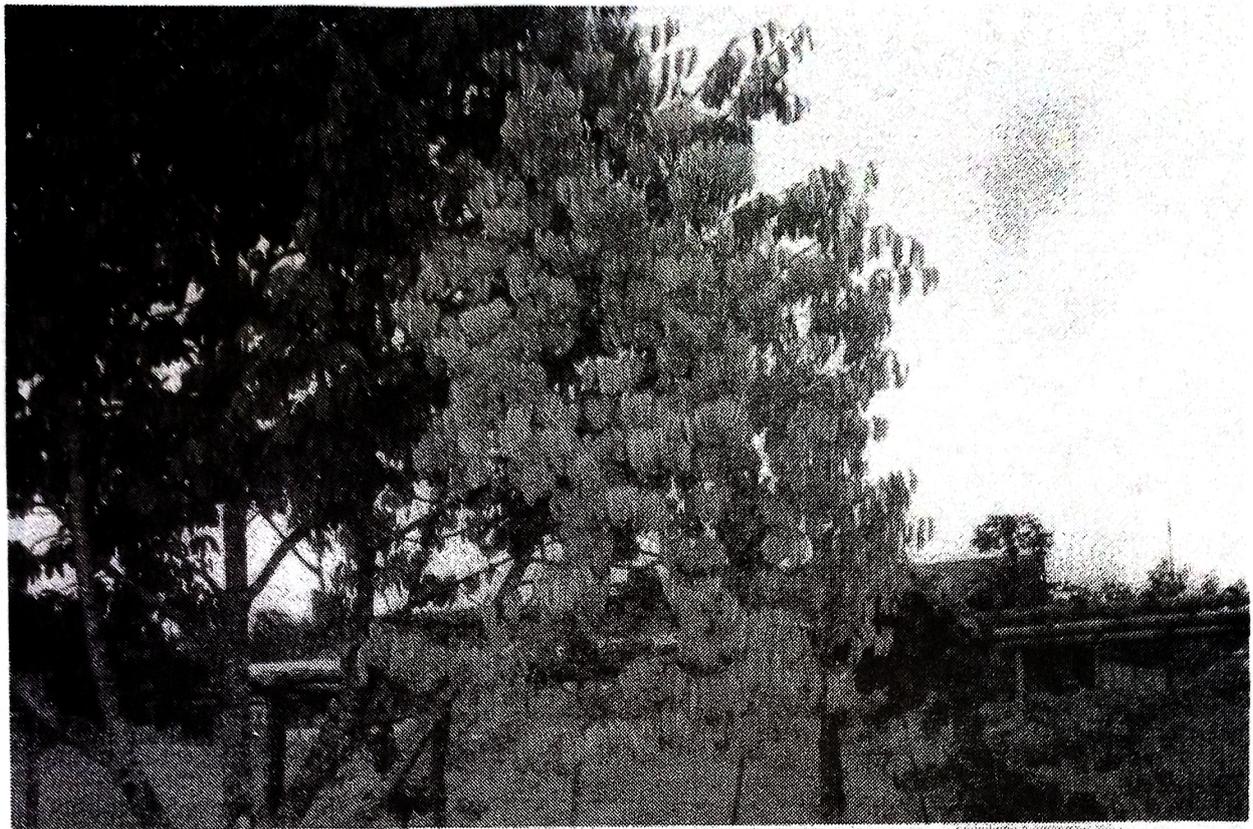
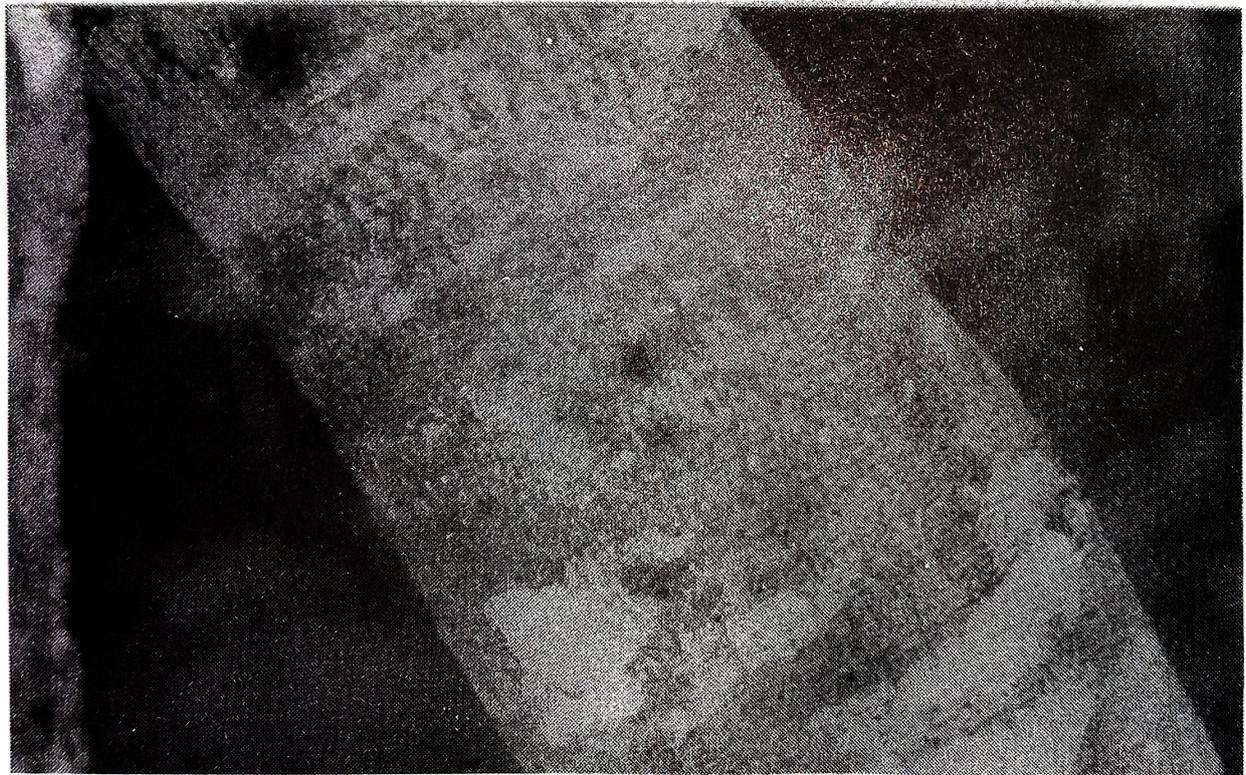


Figure 4. a) Adults and b) larvae of *Conogethes punctiferalis*.
Photographs from website: <http://www.ipmthailand.org>



a



b

Figure 5. (below). a. General yellowing of durian trunk and b. small pinholes caused by the pinhole borer (*Platypus* sp.)



Figure 6. Mealybugs attacking durian fruit. Photograph taken from the website: <http://www.ipmthailand.org>.

B. Beneficial Insects

The beneficial insects associated with insect pests of durian included the parasites and predators. These included five species of ants belonging to family Formicidae, but they were not identified to species level due to unavailability of identification key.

Both adults (Fig. 7a) and larvae of coccinellid beetles (*Micraspis* sp.) were observed on durian fruits. Adult females laid their eggs in-between the spines of durian. Eggs hatched into pale yellow, black spotted larvae which actively crawled around the fruit looking for any available prey.

Syphid flies (Syrphidae) are voracious predators, feeding on aphids, thrips and small caterpillars. The adults are not predatory, but feed on nectar and pollen. Adults resembled bees and wasps but they have only two wings. The larvae look slug-like and are tapered toward the head (http://www.cirrusimage.com/Flies_hover.htm). Unlike

caterpillars, syrphid fly larvae have no legs, which are a great clue for identifying these helpful insects (Fig. 7b & c) (<http://www.clemson.edu/hort/homehort/bisyrlrv.htm>).

The parasitic braconid wasps (*Asobara*) sp. are parasitic on fruit flies maggots. They are commonly called as jaw-wasps because of their “exodont” mandibles, which mean that the mandibles are turned outwards with a strongly developed abductor muscle which provides them with powerful outward movements (Fig.7d), (<http://www.fcla.edu/FlaEnt/fe85p208.pdf>).



Figure 7. a) Ladybird beetle, b) adult syrphid fly, c) larva of syrphid fly & d) adult braconid wasp (www.vegipm.tamu.edu) (http://www.cirrusimage.com/Flies_hover.htm) (www.clemson.edu)

Earwigs are essentially beneficial insects that prey on more harmful insects. The most characteristic feature of earwigs is the pair of pincers or cerci, at the tip of the abdomen. Part of their name comes from an old superstition that they enter people's ears, figure 8, (<http://www.blitzworld.com>)

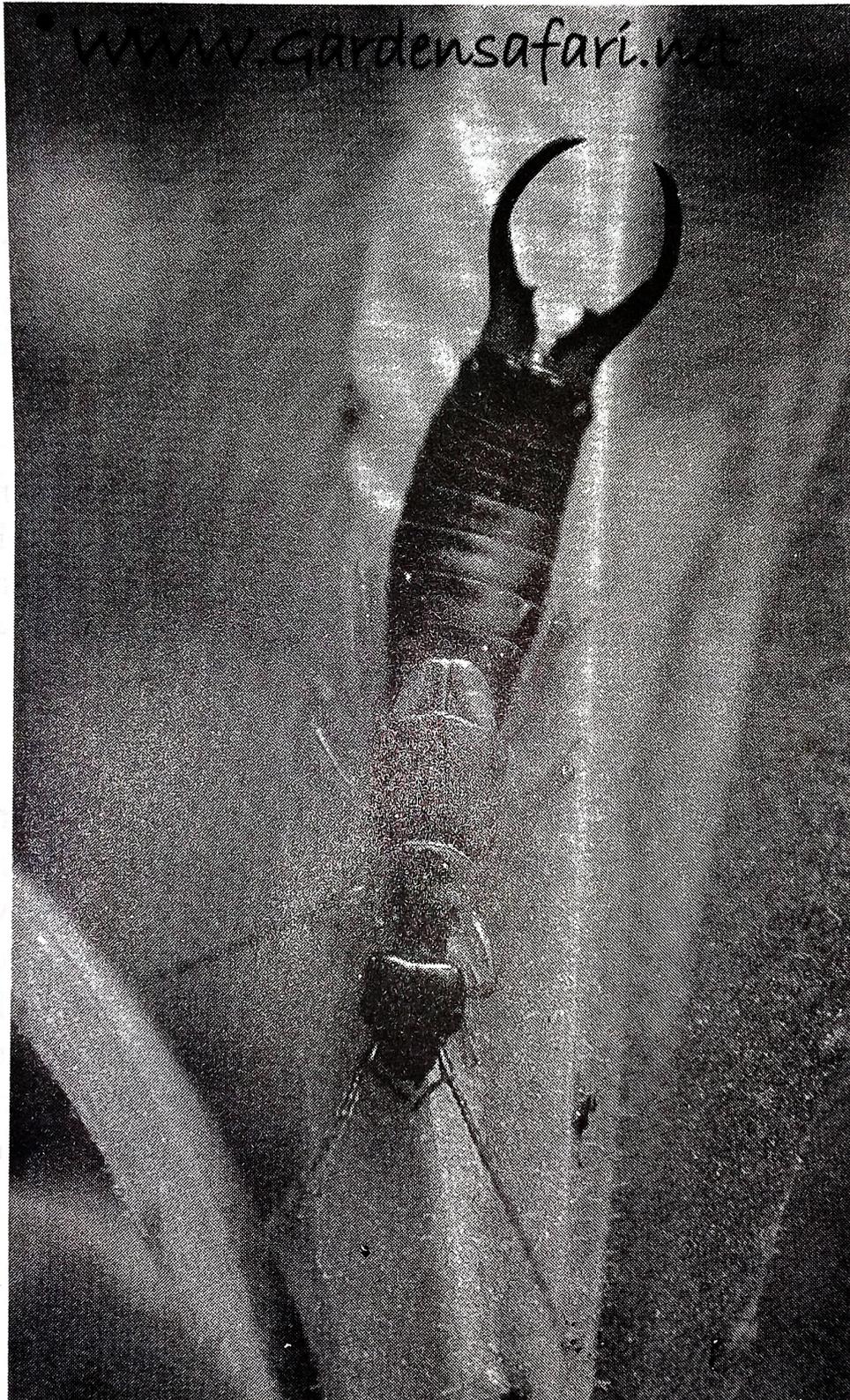


Figure 8. An adult earwig. Photograph taken from website: (www.gardensafari.net)

C. Neutral Insects

Neutral insects included the common outdoor dwelling roaches which were much smaller than the common household cockroaches. They do not thrive and reproduce in homes because they require the consistently moist environment of their natural habitats such as under woodpiles or loose bark and decaying logs (<http://www.ipm.iastate.edu/ipm/iiin/woodcoc.html>).

Seasonal Abundance and Degree of Pest Infestation

Table 3 shows the number and weight of marketable, non marketable durian fruits, percent loss due to insect pests and total fruit sales for the months of August, 2002 to October, 2002.

The total number of harvested fruits was 5,017. The number of marketable fruits was 2,600, weighing 5,636.90 kilograms, while the non-marketable fruits were 2,417 pieces. Durian fruits were damaged mainly by the fruit borers (*C. punctiferalis*) and consisted of 49.82% of the production that were non-marketable.

The fruit borer (*C. punctiferalis*) was the dominant species occurring from the months of March, 2002 until November, 2002. Its presence was easily recognized from the presence of brown to blackish faeces on the outside of the fruits. It was also observed that this pest preferred to attack more when two fruits hung close together. The portion where the two fruits touched provided a kind of refuge for it, thus females tended to select these places to deposit their eggs (www.ipmthailand.org). Population of this pest species declined starting December 2002 and was replaced by the durian seed borer, *M. magniplaga* (Fig.9).

Table 3. Harvest, sales and percent loss of durian fruits due to fruit borers at Matungao Durian Plantation, Sumiorang, Matungao, Lanao del Norte from August 24, 2002 to October 9, 2002 (Farm records, 2002).

Date Harvested	Fruits Harvested				Total Weight of Marketable Fruits (kg)	Total Sales (PhP)
	Non-Marketable	Marketable	Total	Percent Loss		
Aug. 24 - Aug. 30, 2002	160	81	241	66.39	204.40	9,218.10
Aug. 31 - Sept. 6, 2002	153	163	316	48.42	418.20	19,763.00
Sept. 7 - Sept. 13, 2002	208	205	413	50.36	450.80	21,771.00
Sept. 14 - Sept. 20, 2002	518	400	918	56.42	854.00	41,506.00
Sept. 21 - Sept. 27, 2002	736	412	1,148	64.11	877.40	41,298.00
Sept. 28 - Oct. 4, 2002.	424	721	1,145	37.03	1,523.90	71,957.00
Oct. 5 - Oct. 9, 2002	218	618	836	26.07	1,308.20	61,088.00
Total	2,417	2,600	5,017	49.82	5,636.90	266,601.10

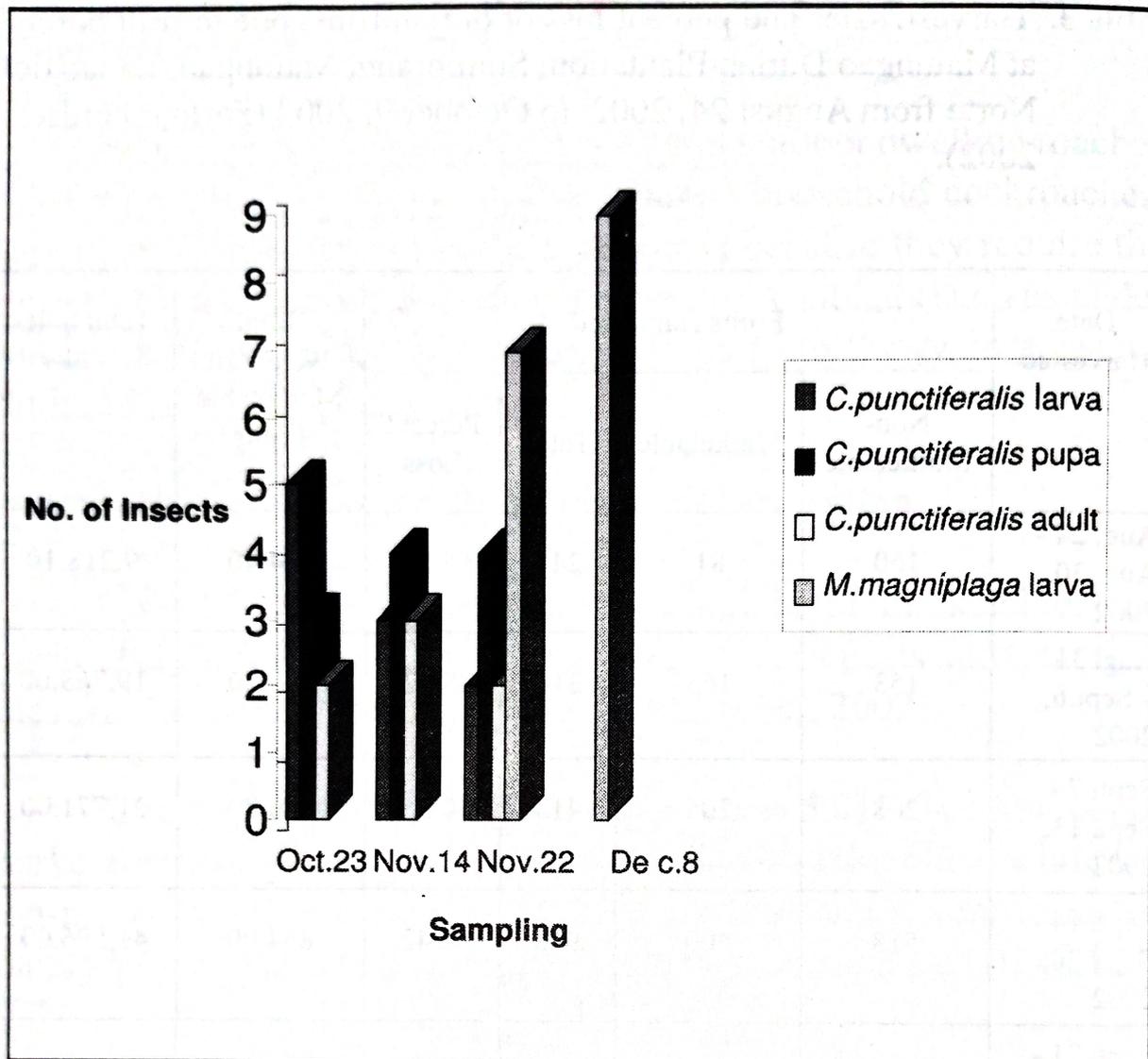


Figure 9. Field population of *M. magniplaga* & *C. punctiferalis*. Matungao Durian Plantation, Sumiorang, Matungao. Lanao del Norte.

The degree of pest infestation by *M. magniplaga* was determined by randomly selecting ten durian trees in the entire plantation for several sampling periods. Damaged and undamaged fruits in both were counted and recorded (Fig.10). Results showed that both the native and improved varieties suffered infestation by this pest at 22.27%, 25.64%, 36.36% and 25.81%, 25.97%, 29.27%, respectively (Table 4). Under field conditions, it was observed that adult moths laid eggs singly on fruits. Newly hatched larvae were not capable of boring the fruits until they reached the late second to third instar stages.

M. magniplaga caused great damage to durian fruits because of its feeding preference. Its larvae fed on the internal part rendering the

flesh inedible (Fig. 11). Larvae of *C. punctiferalis* may also penetrate internally but do not cause extensive damage on the edible part of the fruits.

Life History of *M. magniplaga*

The life cycle of *M. magniplaga* was studied partly under laboratory and field conditions (Table 5).

Initial larval population was taken from infested fruits and reared on excised durian fruits. This method of rearing was unsuccessful, as the larvae did not feed on the excised fruits. They preferred to feed inside the fruit hence they were reared on fresh durian fruits hanging from durian trees planted in the vicinity of the College of Agriculture,

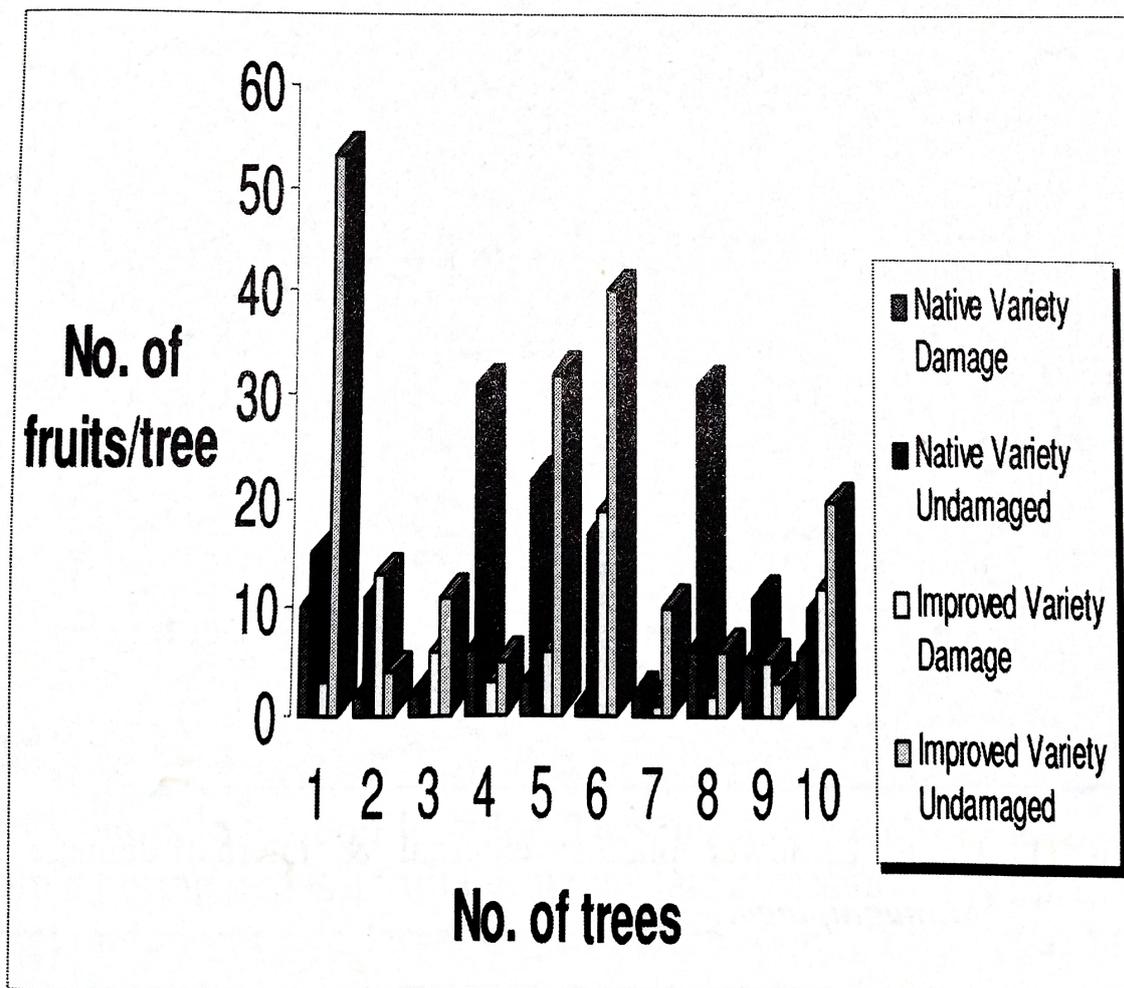


Figure 10. Damage by seed borers (*M. magniplaga*) on local and improved varieties of durian..

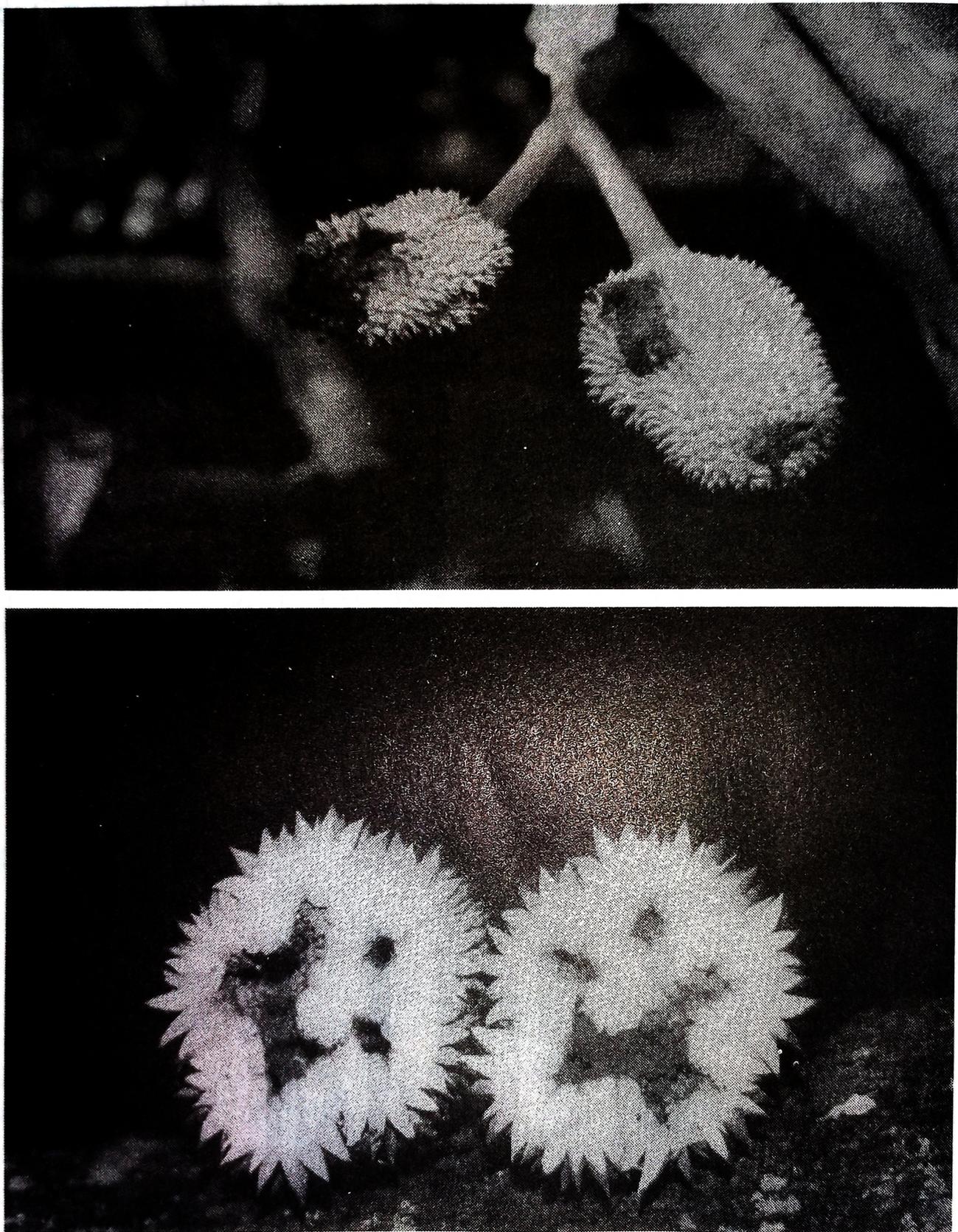


Figure 11. Upper & lower photos: external & internal damage of *M.magniplaga*.

Table 5. Duration of developments stages of the durian seed borer, *M.magniplaga*. College of Agriculture, MSU, Marawi City.

Developmental Period	Average (days)	Range (days)
Incubation Period	12.00	10-14
First Instar	8.00	7-9
Second Instar	5.75	5-7
Third Instar	3.33	3-4
Fourth Instar	4.33	4-5
Fifth Instar	4.50	4-5
Pupal Stage	11.33	10-12
Total Development Period	49.24	43-56
Total Life Span of Adult	10.50	9-12
Total Life Span from Egg To Death of Adult	59.74	52-68

The total developmental period of *M. magniplaga* ranged from 43-56 days with an average of 49.24 days. The duration of the different life stages were as follows: incubation period was 10-14 days with an average of 12.00 days, larval stages ranged from 23-30 days with an average of 25.92 days, pupal stage range from 10-12 days with an average of 11.33 days. The adult life span ranged from 9-12 days with an average of 10.50 days. Similar results were obtained when the life history of this pest was studied in Thailand (www.ipmthailand.org).

Egg. Newly laid eggs are translucent and laid singly on spines of durian fruits. Incubation period ranged from 10-14 days with an average of 12.00 days under laboratory conditions. Eggs turned from pale yellow to orange when about to hatch.

Larva. Newly hatched larvae were minute, had black heads and were pale maroon in color. They usually wandered around and started boring into the fruit during the late second to early third instar. They underwent five larval stages before turning into pupa. Mature larvae were violet-red or maroon in color and fed mainly on seed cotyledons. Total larval stages ranged from 23-30 days with an average of 25.92 days.

Pupa. Mature larvae make holes and come out to pupate in the soil. The pupa was dark brown in color. The total number of days spent by the pupa before adult emergence ranged from 10-12 days, with an average of 11.13 days.

Adult. The adult moth was light gray in color. The forewings had small, whitish, circular marks distributed irregularly throughout the wings. The hind wings had whitish edges but lacked the whitish, circular marks. The adult life span ranged from 9-12 days, with an average of 10-50 days.

SUMMARY AND CONCLUSION

The survey was conducted at Matungao Durian Plantation, Sumiorang, Matungao, Lanao del Norte from March, 2002 to December 2003 with two objectives, namely, to collect and identify the insect pests attacking durian in Lanao and to study the life history of the pest causing the greatest damage to durian.

Three classes of arthropods were found associated with durian. These included the spiders (Arachnida), millipedes (Diplopoda) and insects (Insecta). Among the collected arthropods, insects dominated both in numbers and kinds.

The insect's fauna of durian consisted of seven insect orders belonging to 17 families classified as phytophagous, parasitoid, predator and neutral. The three insect orders that contained pest species were the Lepidoptera (moth), Coleoptera (beetle) and Homoptera (mealybug). The seed borer, *M. magniplaga*, was the major insect pest of durian. Visual counts done throughout the survey consistently showed a high larval population of this pest.

The fruit borer, *C. punctiferalis* was another pest that damaged durian fruits. It caused much damage to durian fruits during the first five months of the survey, but was displaced by the seed borer, *M. magniplaga*. The minor pests of durian included the pinhole borer, *Platypus* sp., and the mealybug, *Pseudococcus* sp.

The duration of the different life stages of *M. magniplaga* was as follows: egg incubation period ranged from 10-14 days with an average of 12.00 days; larval stages, ranged from 23-30 days with an average of 25.92 days; pupal stage ranged from 10-12 days with an average of 11.33 days. The adult life span ranged from 9-12 days with an average of 10.50 days. The total development of *M. magniplaga* ranged from 43-56 days, with an average of 49.24 days.

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Appendix Table. Field Infestation of the Durian Seed Borer, *M. magniplaga*, in Local and Improved (Monthong) Varieties.

Sam-pling No.	Local Variety				Improved Variety			
	Unda-maged	Dama-ged	Total	% Infestation	Unda-maged	Dama-ged	Total	% Infestation
1	150	43	193	22.27%	184	64	248	25.80%
2	58	20	78	25.64%	230	80	308	25.97%
3	35	20	55	36.36%	215	89	304	9.27%