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BIOLOGY OF THE ORCHID WEEVIL, *ORCHIDOPHILUS ATERRIMUS* (WATERHOUSE)

Gliceria A. Hirao[1], Bernardo P. Gabriel[1, 2], and Henry T. Facundo[1, 3]

ABSTRACT

The orchid weevil, *Orchidophilus aterrimus* (Waterhouse), went through egg, five larval instars, pupa and adult stages in 64.72 days on *Dendrobium* leaves and 81.50 days on whole plants. These developmental rates are faster than those reported in Hawaii. Its small oval eggs were laid singly and inserted on the feeding sites of adult weevil either on the stem, leaves or flowers. Newly hatched larva was translucent,later became white to yellowish white and retained this color during the rest of its larval development. The wrinkled legless larva began feeding upon hatching and soon tunneled into the plant. Mature larvae are 5.50 – 8.00 mm (x = 6.63 ± 0.64) long and 1.50 – 2.25 mm (x = 1.78 ± 0.26) wide. The pupa is exarate, with well-developed legs and prominent outline of the wings and antennae. Newly emerged adults remained in the pupal cell and did not feed for at least ten days, They were light to dark brown and became totally black in about seven days. While the larva bores through the stem, adult feeds on flowers and tender tissues. Male and female adults are 4.25 and 1.97 mm long, and 4.43 and 2.03 mm wide, respectively.

Key words: Coleoptera, Curculionidae, life history, orchid pest, orchid weevil, *Orchidophilus aterrimus*

INTRODUCTION

Members of the genus *Orchidophilus*, which is represented in the local fauna by three species, *aterrimus, gilvonotatus* and *peregrinator,* are confined to orchidaceous plants. *Orchidophilus aterrimus* or the orchid weevil is recognized as a major insect pest of orchids in the Philippines (Baltazar, 1986, unpublished report; PCARRD, 1994). This insect was first described as *Baridius aterrimus* by Waterhouse in 1874, but was later assigned to genus *Acythopeus*, and then finally to *Orchidophilus* (Swezey, 1945).

It was first observed in Honolulu in 1910 and has since been intercepted in North American ports on various species of orchids (e.g. *Aerides crassifolium, Coelogyne asperata, Cypripedium curtisii, Dendrobium phaleonopsis, D. pierardii, D. superbum, D. victoria-reginae, Grammatopyllum multiflorum, G. speciosum, Oncidium leopardianum, O. sphacelatum, Phalaenopsis amabilis, P. sanderiana, P. schilleriana, Renanthera alba, Rhyncostylis retusa, Spathoglottis intermedia, Stauropis lissochiloides, Trichoglottis brachiata* and *Vanda luzonica*) from Asian countries including the Philippines (Baltazar, 1986, unpublished report; Swezey, 1945). It has also been found in Singapore and England (Waterhouse, 1874, and Champion, 1913 as cited by Mau, 1983). It is believed to be indigenous to the upper Malayan region

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[1] Department of Entomology, University of the Philippines Los Baños, 4031 College, Laguna

[2] Deceased 31 July 1999

[3] To whom correspondence should be addressed (htf@mudspring.uplb.edu.ph)

(Buchanan, 1935) or the Philippines and the East Indies region (Pritchard, 1959).

Adult feeding may bring about some damage to plants, but severe damages are caused by the larvae (Tanada, 1955). Adult beetles are usually found feeding on flowers and on tender tissues at or near the growing points. The larva is a borer especially near the stem base, where injured and discolored tissue indicates its presence (Fullaway, 1938). It feeds within the leaves and stems of *Vanda, Phalaenopsis,* and *Spathoglottis* (Tanada, 1955).

The development of *O. aterrimus* in Hawaii was studied by Mau (1983). No studies of its life history and habits are reported from Asia. It was, therefore, our aim to study its biology under local conditions.

MATERIALS AND METHODS

Rearing. Field collected adults from *Dendrobium* and *Vanda* hybrids were reared in the laboratory in Ball® jars covered with bond paper and tightly secured with rubber band. Fresh *Dendrobium* and *Vanda* flowers were provided three times a week. The adults were transferred to clean containers thrice a week as well.

Life history studies. Adult weevils from the stock culture were allowed to oviposit on *Dendrobium* and *Vanda* flowers for a 24-hour period. The flowers were then collected and the eggs removed and placed on wet filter paper previously soaked in 10 % sodium hypochlorite solution. The eggs were observed daily to determine the incubation period. Newly hatched larvae were introduced to young *Dendrobium* leaves. Observations and transfer of larvae to fresh substrates were accomplished daily. Body measurements were taken from live insects with the use of an ocular micrometer mounted on a dissecting microscope.

In another experiment, adult weevils were allowed to oviposit directly on whole *Dendrobium* plants. They were released on 20 potted *Dendrobium* plants in cages. After five days, oviposition was assumed, and the weevils were removed. The plants were labeled with the starting date and checked weekly for adult emergence.

All studies were conducted at the Headhouse of the Department of Entomology, U. P. Los Baños, College, Laguna, Philippines.

RESULTS AND DISCUSSION

The orchid weevil undergoes the following stages: egg, five larval instars, pupa, and adult. Body measurements of each developmental stage are summarized in Table 1, while the individual stadia are in Table 2.

Table 1. Measurements of the different developmental stages of the orchid weevil, *Orchidophilus aterrimus* (Waterhouse).

Developmental stage	Number of samples	Length (mm)		Width (mm)	
		Range	Mean ± S.E.	Range	Mean ± S.E.
Egg	24	0.65 – 0.90	0.77 ± 0.07	0.40 – 0.50	0.45 ± 0.04
Larval instar					
First	30	1.00 – 1.80	1.45 ± 0.23	0.40 – 0.60	0.46 ± 0.07
Second	26	2.00 – 3.50	2.82 ± 0.42	0.65 – 0.80	0.73 ± 0.06
Third	28	3.80 – 4.20	3.96 ± 0.11	0.80 – 1.00	0.94 ± 0.08
Fourth	31	4.50 – 5.20	4.84 ± 0.23	1.10 – 1.35	1.20 ± 0.07
Fifth	28	5.50 – 8.00	6.63 ± 0.64	1.50 – 2.25	1.78 ± 0.26
Pupa	10	3.60 – 5.00	4.24 ± 0.46	1.80 – 2.50	2.05 ± 0.24
Adult					
Male	10	3.60 – 4.65	4.26 ± 0.29	1.75 – 2.10	1.97 ± 0.12
Female	20	3.70 – 5.20	4.43 ± 0.39	1.75 – 2.45	1.98 ± 0.24

Table 2. Duration of the different life stages of the orchid weevil, *Orchidophilus aterrimus* (Waterhouse), on *Dendrobium* leaves under laboratory conditions in the present study and compared to Mau's (1983) data in Hawaii.

Life stage	Present study[1]			Mau (1983)[2]	
	Range (days)	Mean ± S.E.	N	Range (days)	Mean ± S.E.
Egg					
Incubation period	5 – 10	6.80 ± 1.62	165	10.5-13	11.3 ± 0.54
Larva (total)			?	3 - >5 mo.	117
First instar	3 – 6	4.50 ± 0.86			
Second instar	2 – 7	4.10 ± 1.49			
Third instar	3 – 14	6.39 ± 2.66			
Fourth instar	5 – 58	27.67 ± 13.76			
Fifth instar	20 – 45	32.67 ± 12.50			
Pupa	9 – 12	10.33 ± 0.91	26	13 - 18	15.9 ± 1.2
Total (egg to adult)	48 – 86	64.72 ± 12.30	?	?	144

[1] Based on 10 randomly selected specimens; 28 - 35 °C
[2] in Hawaii, 24 ± 4 °C

Eggs. The small, 0.65 – 0.80 mm ($\bar{x}$ = 0.72 ± 0.06) long and 0.40 – 0.50 mm ($\bar{x}$ = 0.46 ± 0.04) wide (Table 1), oval eggs were laid singly and inserted on the feeding sites of the adult weevil either on the stem, leaves, or flowers. There were no differences in appearance between feeding cavities with and without eggs, which coincides with Mau's (1983) observations. A day or two after egg deposition a yellowish band can be seen at the center through the chorion, which was the developing larva. The mandibles of the developing larva became visible as brown triangular spots one or two days before hatching. As the incubation period drew to a close, the position of the larva within the egg was clearly visible. At the end of the incubation period, the larva punctured the egg membrane using its large mandibles. By extending its body, the larva was able to tear the membrane sufficiently to escape. Incubation period ranged from 5 – 10 days ($\bar{x}$ = 6.80 ± 1.62). Mau (1983) reported a longer incubation period ranging from 10.5 – 13 days ($\bar{x}$ = 11.3 ± 0.54) (Table 2).

Larva. The newly hatched larvae were 1.00 – 1.80 mm ($\bar{x}$ = 1.45 ± 0.25) long and 0.40 – 0.60 mm ($\bar{x}$ = 0.46 ± 0.07) wide (Table 1), initially translucent and later became white to yellowish white which was the color throughout the developmental period. Its head capsule was light brown upon hatching then later turned dark brown. The wrinkled, legless larva immediately began to feed after hatching and soon tunneled into the plant with movements caused by contractions of its body (Figure 1).

The sclerotized head is distinct, with hypognathous mouthparts and robust mandibles. The three thoracic segments are distinct, each with enlarged swellings where legs usually arise. The abdomen possesses 10 segments with three pleats on the dorsal aspect of the first seven segments. The last three are somewhat modified and reduced segments. Spiracles are located at the mesothorax and abdominal segments I to VIII.

The stadia of the late larval instars varied greatly as reflected in the wider range and larger standard error values (Table 2). Some weevils passed through only three to four molts. However, Mau (1983) noted a minimum of five but possibly six larval instars. The first to fifth larval stadia were as follows: range of 3 – 6 $\bar{x}$ = 4.50 ± 0.86), 2 - 7 ($\bar{x}$ = 4.10 ± 1.49), 3 – 14 ($\bar{x}$ = 6.39 ± 2.66), 5 – 58 ($\bar{x}$ = 27.67 ± 13.76), and 20 – 45 days ($\bar{x}$ = 32.67 ± 12.50), respectively (Table 2). Mature larvae were 5.50 – 8.00 mm ($\bar{x}$ = 6.82 ± 0.84) long and 1.50 – 2.25 mm ($\bar{x}$ = 1.90 ± 0.27) wide (Table 1). Mau (1983) reported that mature larvae were 8 – 9 mm long and 3 mm wide with larval period ranging from three to more than five months ($\bar{x}$ = 117 days).

Molting in the larva was accomplished by splitting of the head capsule along the epicranial sulcus and passage of the exuvia backward by writhings of the body. The molted head capsule passed along the ventral surface. The exuvia consisted mainly of head capsule together with a tightly wadded ring of body material.

Larval feeding within the pseudobulbs resulted in longitudinally oriented galleries that are filled with frass up to a short distance behind the larva. Normally, this damage would cause stoppage of growth and flower production in *Dendrobium*, whereas *Vanda* could continue to grow despite infestation although color breaks in flowers frequently occur (Mau, 1983).

When fed with excised *Dendrobium* leaves, the larva constructed a pupal cell made of food materials. In contrast, when allowed to feed on whole plants, the larva sealed its gallery with fibers and frass and pupated within them. Two to three days before the cessation of the larval period, the larva passed through a prepupal stage when it turned creamy white, its thoracic region constricted, and became less active.

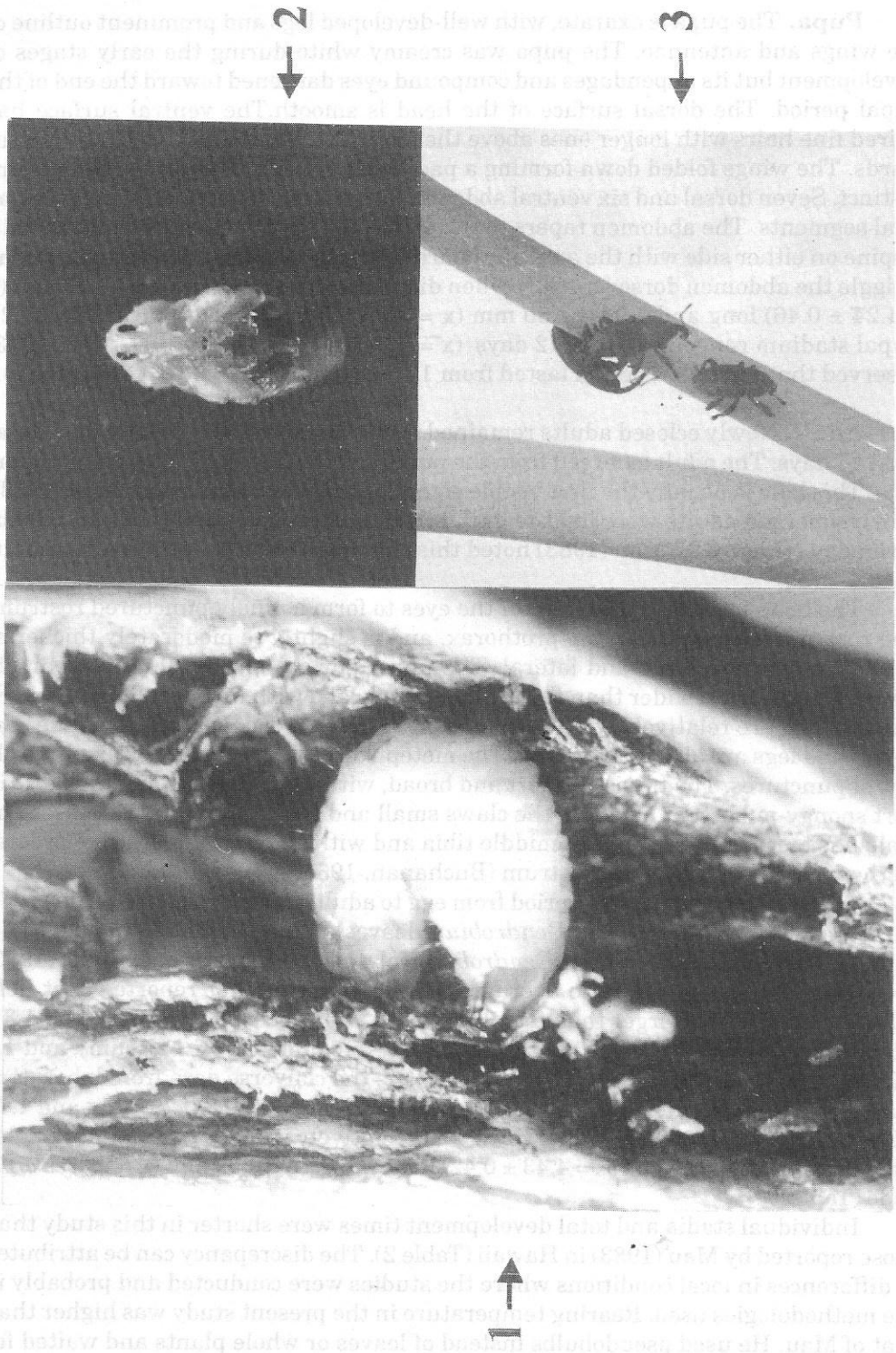

Figure 1-3. *Dendrobium* stem opened to expose a fifth instar larva (1); a pupa (2); and adults (3) of the orchid weevil, *Orchidophilus aterrimus*.

Pupa. The pupa is exarate, with well-developed legs and prominent outline of the wings and antennae. The pupa was creamy white during the early stages of development but its appendages and compound eyes darkened toward the end of the pupal period. The dorsal surface of the head is smooth.The ventral surface has paired fine hairs with longer ones above the eyes. The snout and legs curled downwards. The wings folded down forming a pad on either side. Thoracic segments are distinct. Seven dorsal and six ventral abdominal segments are visible, plus two short anal segments. The abdomen tapers to the extremity, each segment furnished with a spine on either side with the anal one bearing two and a paired urogomphi. Pupae wriggle the abdomen dorsoventrally when disturbed. The pupa is 3.60 – 5.00 mm ($\bar{x}$ = 4.24 ± 0.46) long and 1.90 – 2.50 mm ($\bar{x}$ = 2.05 ± 0.24) wide (Table 1; Figure 2). Pupal stadium ranged from 9 – 12 days ($\bar{x}$ = 10.33 ± 0.91). In contrast, Mau (1983) observed that the pupal period lasted from 13 – 18 days ($\bar{x}$ = 15.90 ± 1.2) (Table 2).

Adult. Newly eclosed adults remained in the pupal cell and did not feed for at least 10 days. The adult emerged from the pupal cell by chewing a circular or oblong hole. This hole is usually the first visible sign that the plant is infested (Mau, 1983). Newly emerged adults were light to dark brown and became totally black in about seven days (Figure 3). Mau (1983) noted this change in color 3 – 4 days after adulthood.

The head is produced in front of the eyes to form a finely punctured rostrum. The rostrum is longer than the prothorax, and is slightly to moderately thicker at base. The eyes are large and lateral. The upper surface of the thorax is coarsely pitted. The elytra is wider than the prothorax, marked with fine parallel punctured striae which are relatively wide, deep and clean cut. On the undersurface, the segments and legs are also finely pitted. The metepisternum has double or partly triple row of punctures. The tarsi are short and broad, with 2nd and 3rd segments and 1st in part spongy-pubescent beneath, the claws small and sub-approximate at base. The male has tooth on inner edge of middle tibia and with sub-apical tooth-like process on the ventral surface of the rostrum (Buchanan, 1935).

The total developmental period from egg to adult ranged from 48 – 86 days ($\bar{x}$ = 64.72 ± 12.31) when reared on *Dendrobium* leaves (Table 2) and 67 – 94 days ($\bar{x}$ = 81.50 ± 10.37) when reared on *Dendrobium* plants (2nd experiment). Mau (1983) noted that the entire life cycle averaged 144 days. He further reported that field collected males were larger than females (3.5 – 5.7 mm long [$\bar{x}$ = 4.8 mm], and 1.3 – 2.5 mm pronotal width [$\bar{x}$ = 2.0 mm], versus 3.1 – 5.0 mm long [$\bar{x}$ = 4.4 mm], and 1.2 – 2.0 mm pronotal width [$\bar{x}$ = 1.7 mm]). We have the converse data from laboratory reared individuals. Adult males were 3.60 – 4.65 mm ($\bar{x}$ = 4.25 ± 0.29) long and 1.75 – 2.10 mm ($\bar{x}$ = 1.97 ± 0.12) wide, which were relatively smaller than adult females which were 3.70– 5.20 mm ($\bar{x}$ = 4.43 ± 0.42) long and 1.75 – 2.35 mm ($\bar{x}$ = 2.03 ± 0.17) wide (Table 1).

Individual stadia and total development times were shorter in this study than those reported by Mau (1983) in Hawaii (Table 2). The discrepancy can be attributed to differences in local conditions where the studies were conducted and probably in the methodologies used. Rearing temperature in the present study was higher than that of Mau. He used pseudobulbs instead of leaves or whole plants and waited for the first adult to emerge from the pseudobulbs before checking the rest of the insects. This procedure might have skewed his data towards longer stadia because

adults remain in the plant for several days after eclosion. Our data in the first and second experiments using leaves and whole plants, respectively, support this explanation as they show a discrepancy of about 17 days on the average for the total developmental period. The longer period on whole plants was due to the longer time spent by adults within the substrate.

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LITERATURE CITED

BUCHANAN, L. L. 1935. A new genus and species of orchid weevils (Coleoptera, Curculionidae, Barinae). Proc. Hawaii. Ent. Soc. 9 (1): 45–48.

FULLAWAY, D. T. 1938. Orchid insects. Proc. Hawaii. Ent. Soc. 10: 45–49.

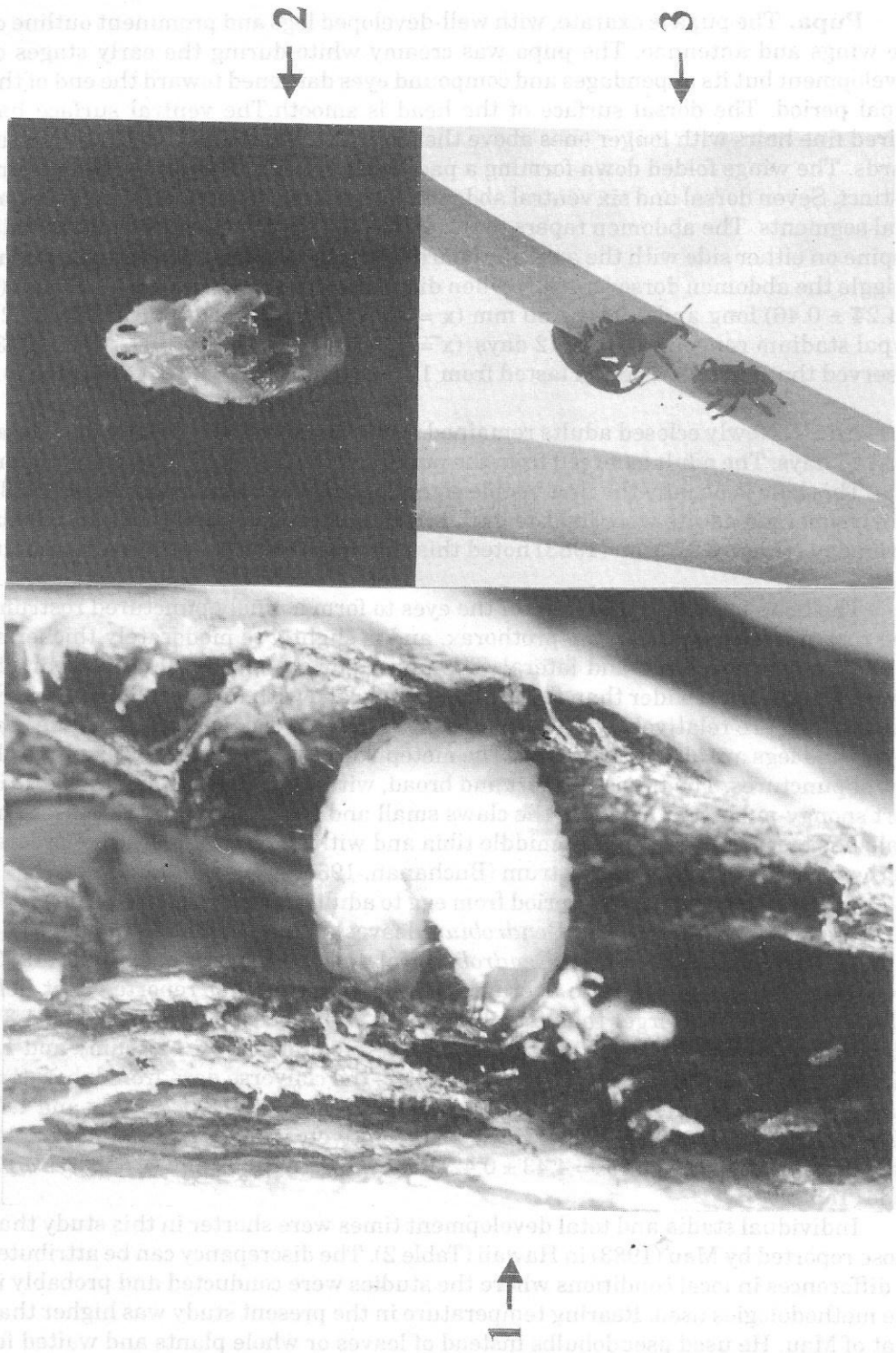
MAU, R. F. L. 1983. Development of the orchid weevil, *Orchidophilus aterrimus* (Waterhouse). Proc. Hawaii. Ent. Soc. 24 (2 & 3): 293–297.

PCARRD. 1994. Orchid pests and their control. *In* The Philippines Recommends for Orchids, pp. 87 – 98. Los Baños, Laguna: PCARRD.

PRITCHARD, A. E. 1959. Orchid pests and their control. *In* Withner, The Orchids: A Scientific Survey, pp. 459–475. New York: Ronald Press Co., 648 p.

SWEZEY, O. H. 1945. Insects associated with orchids. Proc. Hawaii. Ent. Soc. 12(2): 343–362.

TANADA, Y. 1955. Some fundamental apects governing the control of orchid pests. Na Pua Okika o Hawaii Nei. 5(1): 2–9.



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