Larvae began to burrow in soil in preparation for pupation 36–45 days after egg hatch. Mortality was high at this stage: of 45 larvae that burrowed, only 18 pupated. Larvae pupated under dead leaves and pieces of wood, just under the soil surface, and up to 16.5 cm underground in the rootball of senescing hostplants. Pupation usually occurred in firmly packed ovate cells. The cremaster possesses a bifurcate tip as depicted by Osborne (1995) for *Proserpinus clarkiae* (Boisduval) (Sphingidae).

The 18 pupae were maintained outside in a ventilated plastic tub in Berkeley until November when they were placed in a refrigerator at 1.7°C ± 1°C. No development was evident in the pupae until they had been moved from refrigeration to outside temperatures (between 8–20°C) for more than 45 days. J Kruse (pers. com.) found that daily cycling of pupae removed from a refrigerator (3°C) to room temperature (18°C) for approximately 4–8 hours, also induced eclosion. The green coloration of the developing wings was visible through the pupal cuticle for two days before the moths emerged. The cuticle became very soft 24 hours before emergence.

Adults eclosed from 8–19 March 1998, usually between 1800 and 1900 h PST; they took 1–2 hours to dry their wings. Adults in cages were active only from 1800 to 1930 h PST, though mating occasionally lasted a few hours longer. Virgin females rested on the substrate, everting and pulsating the papillae anales to disperse pheromone (Fig. 1). When a male was placed in the same enclosure he rapidly approached the female and mated. If no male arrived by 2000 h PST, females stopped calling until the next sunset. One male fertilized three females; those females laid 369, 397, and 401 eggs respectively.

Arctonotus lucidus pupae apparently are able to develop when surface temperatures still regularly fall below freezing. Eggs hatch and larvae begin development when most apparent hostplants are less than 2 cm high, and night temperatures occasionally fall below 0°C.

Hodges (1971) stated that adults can be collected during the day while nectaring on flowers. I suspect this report to be in error since all collections throughout the range of the moth, that I have been able to document, were made at lights, and none of the moths I reared was active during the day. Moreover, the adults do not feed.

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EMERGENCE OF PARASITIC FLIES FROM ADULT *ACTINOTE DICEUS* (NYMPHALIDAE: ACRAEINAE) IN ECUADOR

Additional key words: parasitoid, adult Lepidoptera, neotropics, *Arachidomyia.*

A parasitoid is defined as 'an organism which develops on or in another single (host) organism, extracts nourishment from it, and kills it as a direct or indirect result of that development' (Eggleton & Gaston 1990). In contrast parasites rarely kill their hosts and predators always consume more than one host. In addition, parasitoids possess a free-living adult stage (whereas many parasites do not), and do not reproduce inside the host (as do many parasites). Insects with parasitoid life cycles are known from many taxanomic groups including many families of Hymenoptera and Diptera (Eggleton & Belshaw 1992), yet knowledge of host specificity and parasitoid lifecycles remains patchy. Host relationships are known for only a small percentage of parasitoid taxa in the tropics (e.g., references in Hanson & Gauld 1995), and many parasitoid species remain undescribed due to their often small size and highly specialized lifestyles (Gaston 1991). The emergence of parasitoids from adult Lepidoptera is infrequently reported in the literature (e.g., Marshall 1896, Cockayne 1911, Edelsten 1933, DeVries 1979, Smith 1981, McCabe 1998). The following record of sarcophagid flies emerging from adult butterflies in Ecuador represents the first record of this in several years, and only the second record involving Sarcophagidae.

On 8 December 1996 three female *Actinote diceus* Latreille were collected at Cabañas San Isidro, located at around 2000 meters elevation in north-eastern Ecuador. All were flying normally along a road cut through disturbed cloud forest and cattle pasture. At the time of collection all three butterflies were killed by a quick pinch to the thorax, as described by DeVries (1987), placed together inside a glassine envelope, and marked with the date and locality. The specimens were then placed together in a plastic tub with other specimens collected that day and returned to the lab. Upon arrival at the lab and inspection of the specimens, two fly pupal exuviae were found inside the envelope with the three *Actinote* females. Two adult sarcophagid flies were also present inside the envelope. These adults were identified using Shewell (1987) as belonging to the genus *Arachidomyia* Townsend. Due to eclosion inside the glassine envelope, both specimens were badly damaged and could not be identified to species. Another empty puparium was found in an envelope containing a fourth individual female *A. diceus* collected on the same date, but no adult fly was recovered. Lepidopteran specimens were retained in the collection of the senior author and the dipteran specimens were deposited in the Tulane University collection.

Sarcophagid flies develop on a wide variety of food resources and range in habit from detritivores to predators and parasitoids of invertebrate and vertebrate hosts (Clausen 1940). The parasitoid habit appears to have evolved on many separate occasions, and about half

of the described species can be considered parasitoids or cleptoparasitoids. Of these, approximately 750 species can be considered true internal parasitoids (Eggleton & Belshaw 1992). Parasitoid Sarcophagidae are known to develop inside adult hosts of a variety of insects and vertebrates including Orthoptera, spiders, gastropods, and lizards (Shewell 1987, Allen & Pape 1996, Dial & Roughgarden 1996, Danyk et al. 2000, Pape et al. 2000). A number of Sarcophagidae, including *Arachidomyia*, have been reared from lepidopteran pupae (Clausen 1940, Shewell 1987, Parry 1995) and McCabe (1998) reported *Sarcophaga* (=*Arachidomyia*) *aldrichi* Parker emerging from adult moths, but large scale larval lepidopteran rearing projects have found very few instances of parasitism by sarcophagids (Janzen & Hallwachs 1999, Dyer & Gentry 2001, Stireman & Singer unpublished data). In our area, little is known of the life history of *Actinote diceus*. Adults and larvae are present yearround and found in association with their larval food plant, *Erato polymnioides* DC (Asteraceae) (Greeney et al. 2001). While their adult lifespan is unknown adult females live only a few days in captivity (HFG unpublished data). McCabe (1998) argued that attack by *Arachidomyia* occurred during the adult stage of the host, however in the present case this is unlikely due to the "fresh" appearance of the adult butterflies and the rapidity with which the adult flies appeared. We suspect that the parasitized individuals were attacked as pupae.

Knowledge of parasitoid/host associations is necessary for understanding the structure and function of ecological communities, developing theories of parasite/host population dynamics, and establishing of sound biological control programs (Godfray 1994, Hawkins 1994, Hawkins & Sheehan 1994, Jervis & Kidd 1996, VanDriesche & Bellows 1996). Reports of parasitism of adult Lepidoptera are rare, but extensive rearing programs, especially in poorly studied tropical ecosystems, are needed to assess whether these relationships tend to be facultative or obligate and generalized or specialized. Such rearing data is also needed to determine how parasitism of adults is achieved (i.e., via immature stages or directly) and to assess the prevalence of this life history strategy and how it may effect host populations. We hope that this report encourages further research on tropical parasitoid-host relationships and the prevalence of adult parasitism in Lepidoptera.

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ERRATA

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In the above article by Harold. F. Greeney and John O. Stireman (Journal of the Lepidopterists' Society 55(2):79–80), the genus name of a parasitic fly was misspelled. Where it reads "*Arachidomya* sp." (pp 79 and 80) it should read "*Arachnidomya* sp."

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