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NOTE ON THE ECOLOGY OF *CYRTODACTYLUS KOTSCHYI* (REPTILIA - GEKKONIDAE) IN AN INSULAR ECOSYSTEM OF THE AEGEAN*

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Cyrtodactylus kotschyi (Reptilia-Gekkonidae) and *Podarcis erhardii* (Reptilia-Lacertidae) are among the commonest species in the insular ecosystems of the Aegean. The distribution and systematics of *C. kotschyi*, has been studied sufficiently in the Aegean (O. Wettstein 1953, Beutler 1981, e.a.).

The ecology of the geckoes has been studied in Europe and Israel (Scebak, 1960, Werner 1966, 1978, e.a.) and in other areas were Gekkonidae are distributed (Pianka & Huey 1978, e.a.). On the contrary, the ecology of *C. kotschyi* in the Aegean ecosystems has been studied less. Some data on its ecology are mentioned in Beutler (1981) and Beutler & Gruber (1977, 1979).

In this report the first data on its ecology in the Aegean insular ecosystem are reported for July (15-25) and November (19-23) of 1986.

Localities and Methods

Animals were mostly collected from an insular ecosystem located on the eastern part of Naxos island (the largest in Cyclades) 5 Km south of the small village of Moutsouna, in an area which was described by Valakos (1983, 1986). Other observations were made on 12/7/86 on Agios Georgios Island in the Argosaronic Gulf.

Geckoes were captured in summer by noose or by airgun. In November, animals were captured by hand in random squares of 5m×5m where we searched all the borrows for density studies.

Time, body length (snout-vent), tail length, condition of the tail, weight, body temperature (Tb) (with quick reader cloacal thermometer, Miller and Co), air temperature (Ta) 5cm above the site of the gecko and substrate (Ts) temperature were recorded for each gecko. Geckoes were fixed in 75% alcohol.

The contents of each stomach, the eggs in females' oviducts and the condition of the oviducts, were examined under dissecting microscope in the laboratory.

Results

Activity and thermal ecology: Body temperature (Tb), time at which the ani-

mals were collected during July and November and the associated environmental temperatures are given in tables 1 and 2.

In summer, the geckoes appear in two periods of the day. One period between sunrise (06.30 am) until 10.00 am and a second period between sunset (07.00 pm) until 09.30 pm. Air temperature ranges in the morning from 26°C-31°C and in the evening from 26.3°C-28°C. In this time, the individuals of *C. kotschyi* bask on the stones. Between 10.00 am to 07.00 pm animals are not observed. The mean body temperature is 30.7°C±1,7°C, ranging from 26.6°C to 35.7°C. This mean body temperature is 1.96°C±0.85°C higher than Ts and 3.28°C±1.19°C than Ta (max. +9°C).

In November, the individuals are basking when Ta is 18°C-20°C and Ts is up to 23°C. Mean body temperature in November is 23.32°C±1,99°C, but the animals bask when Tb is up to 25°C. In November, Tb is 2.48°C±1,91°C higher than Ts and 4.92°C±2,25°C higher than Ta.

Diet: The types and the percentage of the food items found in the stomachs of 17 geckoes which were collected in July and of 10 geckoes which were collected in November, are presented in fig. 1.

C. kotschyi feeds mainly on arthropods. Insects were the most common item (about 90% in July and 60% in November). A large number of geckoes in July prefered larvae of coleoptera, the percentage of this prey beeing high (70%). The second most important food items were adult coleoptera (7%) and spiders (7%).

In November the most important food items prefered by *C. kotschyi* were spiders, ants and diptera.

Reproduction: The reproductive condition of 25 females (which were collected in July) was determined by observation of oviductal eggs and the oviducts.

Thirteen of the geckos had just laid eggs as judged from the greatly enlarged oviducts. Two females contained enlarged oviductal eggs, the first two, 4.5 mm × 7 mm and the second one, 4.48 mm × 7.1 mm. The mean clutch size was 2.25 eggs. All the animals contained small ovarian eggs (4-6.1 mm). The smallest female which contained oviductal eggs was 37.8 mm in length.

Eggs were found on Agios Georgios Isl. on 12/7/86. These eggs were found under stones and had calcic shells. Five of them hatched in the laboratory, 3 at 1/8/86 and two at 28/8/86. The mean body length (snoutvent) of the offspring was 22 mm and their weight 0.2 gr. In November in Naxos Isl. four juveniles were found with body length 24.4, 23.1, 22.8, 22.0 mm and weight 0.2 0.3 gr. From this observation we the first offsprings appear from August until October.

Predation: The percentage of regenerated or broken tails was 19% in July and 25% in November. Raptors, snakes and lizards are the major lizard predators (Pianka, 1971). The dominant species of lizard in Naxos' island biotope,

is the cycladian rock lizard, *Podarcis erhardii* (Reptilia - Lacertidae). Its density is about 70 individuals per hectare (Valakos, 1983). *Vipera ammodytes* (Reptilia - Viperidae) is the dominant snake species. Its density is about 5 individuals per hectare. The other snakes are the sand boa *Eryx jaculus* and the four line snake *Elaphe quatorlineata*. Their densities are low (<1 ind. per hectare). We found a juvenile gesko in the stomach of a male *P. erhardii* and a gecko in the stomach of a male *V. ammodytes*.

Density: We searched 40 random squares in November of 1986. We found 10 individuals of *C. kotschyi*, the estimated density of the population beeing thus 100 ind/ha.

Discussion

It seems that *C. kotschyi* belongs to the diurnal lizards because its Tb, mainly in summer, is high. The nocturnal geckoes have smaller Tb than the diurnal (Pianka & Huey, 1978). Tb's of *Ptyodactylus hasselquistii*, which is a diurnal gecko is 32°C at Namib desert (Werner, 1978). Also the Tb of *C. kotschyi* was known to be higher than air temperature (Pianka & Huey, 1978).

Beutler (1981) reports that *C. kotschyi* is the most diurnal gecko of Europe while Werner reported that *C. kotschyi* is a mainly nocturnal species but basks in the sun (Werner, 1966). Our opinion is that *C. kotschyi* in the summer is active in the twilight zone of the day, but in other seasons its activity depends on the air temperature and substrate temperature.

C. kotschyi is mainly an insectivorous lizard, as it is shown by the high percentage of insects in the prey. The same qualitative diet was reported for *C. kotschyi* from Greece (Beutler & Gruber, 1979). Also *C. k. danilewskii* has the same composition of prey in its diet (Scebak, 1960). The percentage of insects in Kalahari desert geckoes is high (Pianka & Huey, 1978) and the diurnal gecko *Ptyodactylus hasselquistii* in Israel, feeds mainly with insects (Perry & Werner, 1981).

Food strikingly differed between July and November showing the geckos' opportunism. *C. kotschyi* is mainly a sit-and-wait predator: there were several mobile animals in its prey and also the percentage of some types of prey is very high (e.g. larvae of coleoptera 70%) (Huey & Pianka, 1981).

Beutler (1981) reported that the reproductive season begins in the Aegean in May and lasts until October. From our results it seems that in the Aegean, the reproductive season begins from the middle of spring until October. The mean clutch size is small. Gekkonidae in Kalahari desert have a small clutch size (1-2) (Pianka & Huey, 1978). The absence of enlarged ovarian eggs reflected that *C. kotschyi* produces one clutch per season.

Based on the presence of oviductal eggs, the minimum size for female *C. kotschyi* at sexual maturity was 37.8 mm. Beutler (1981) reported that the

length of *C. kotschyi*, one and a half years after its birth, is 36 mm. Late maturing species with single clutches per season are generally characteristic of late maturing - long lived species (Tinkle et al, 1970). Some data on the survival of *C. kotschyi* show that this gecko survives for 6 years to 9 years after its birth (Werner 1966, Beutler 1981).

The predation of *C. kotschyi* is small. The ground dwelling geckoes have a small percentage of broken tails (Pianka & Huey, 1978). Also *C. kotschyi* is a cryptic animal; it camouflages its silhouette by disruptive coloured markings of the body, like the flying gecko *Ptychozon kuhli* (Edmunds, 1974), or harmonizes its colour with its background.

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Bibliography

Beutler, A., 1981 – *Cyrtodactylus kotschyi* – Aegaischer Bogenfinergecko. In Handbuch der Reptilien und Amphibien Europas. Ed. W. Bohme. Band I Akad. Verl. Wiesbaden 1981.

Beutler, A. & Gruber, 1977 – Intraspezifische Untersuchungen an *Cyrtodactylus Kotschyi*. Beitrag zu einer mathematischen Definition des Begriffes Unterart. *Spixiama* 1,2: 165-202.

Beutler, A. & Gruber 1979 – Geschlechtdimorphismus, Popylationdynamic und Okologie von *C. kotschyi*. *Salamandra* 15,2: 84-94.

Edmunds, M., 1974 – Animal defence, Longam (London).

Huey, R. & Pianka, E., 1981 – Ecological consequences of foraging mode. *Ecology* 62(4): 991-999.

Perry, C. & Werner, Y., 1981 – Food of *Ptyodactylus hasselquistii quttatus* at two location in Israel in summer. *Is. J. Zool.* vol. 30: 98 99.

Pianka, E., 1971 – Comparative Ecology of two lizards. *Copeia* 1971 (1): 129-138.

Pianka, E. & Huey, R. 1978 – comparative ecology, resource utilization and niche segregation among Gekkonidae lizards in the southern Kalahari: *Copeia* 1978 (4): 691-701.

Scebac, N., 1960 – New data of the Crimean gecko *C. kotschyi danilewskii*. *Str. Zool.* 2. 39: 1390-1397.

Tinkle, D.W., Wilbur, M.H., Tilley, S., 1970 – Evolutionary strategies in lizard reproduction *Evolution* 24: 55-74.

Valakos, E., 1983 – Preliminary report on the ecology of *P. erhardii* in an Aegean island population. In *International Conference on terrestrial and freshwater vertebrates from the Mediterranean islands. Eviza* (Corse) Theme 5 S.4.

Valakos, E., 1986 – The feeding ecology of *Podarcis erhardii* (Reptilia - Lacertidae) in

a main insular Ecosystem. *Her. Jour. (Lon)* vol. 1: 118-121.

VITT. L. & LACHER, T., 1981 – Behaviour habitat, diet and reproduction of the iguanid lizard *Polychrus acutirostris* in the caatinga of N.E. Brazil. *Herpetologia* 37(1): 53-63.

WERNER, Y., 1966 – *Cyrtodactylus kotschyi orientalis* in Israel. *Lacerta* 24(12): 94-96.

WERNER. Y., 1978 – Body temperatures in a basking Gekkonid lizard *Ptyodactylus hasselquistii. Jour. of Herp.* 12(3): 408-411.

WETISTEIN, O., 1953 – Herpetologia Aegea. *Sitzber. Akad. Wiss. Wien math-naturw.* Kl 1, 162 bd 9 und 10. heft.

Time	Tb	Tb-Ts	Tb-Ta
7.35	26.6	2	2.6
7.55	30.4	1.7	2.3
8.05	35.2	5.2	4.8
8.17	32.2	5	5.5
8.20	34.6	1.6	6.3
8.29	30.4	3.6	4.1
8.26	30.4	1.4	3.4
8.30	27.8	.8	1
8.35	35.1	5.1	7.1
8.35	28.6	-.9	1.6
8.40	33.4	3.4	4.4
8.40	33.8	3.5	4.5
8.45	34.2	5.2	5.2
8.50	34.8	2.4	5.2
8.50	26.6	1	1.7
8.54	26.6	.8	.6
8.54	28	1.8	2
8.55	33.4	3.4	6.4
9.00	33	-.8	2
9.00	37.2	5.2	9.2
9.00	27	2	2.5
10.15	0	2.5	4.5
19.20	29.4	1.2	3.1
19.40	26.9	-1.1	.3
19.42	29.4	.2	2.2
20.00	29.6	-.2	3
20.15	28.4	.2	.5
20.30	28	.8	1.6
20.33	28.2	.9	1.6
20.55	28	1	1.4
21.05	27.4	1	1.1
T+-S.D	30.7	1.96	3.28
	± 1,7	±0.85	±1,19

Tab. 1. Relations between Tb and the ambient temperatures (July)

Time	Tb	Tb-Ts	Tb-Ta
10.10	21.8	3.6	2.9
10.22	22	4.2	4.2
10.25	22	2.9	4
10.50	21.4	2.9	5.6
10.55	23.2	3	3.6
12.14	25.8	1.9	7.6
12.20	22	-1.9	3.8
12.32	22.6	3.2	2.5
12.46	25.4	.3	5.2
13.15	27	3.7	9.8
T+-S.D	23.32	2.48	4.92
	±1.99	±1,91	±2,25

Tab. 2. Relations between Tb and the ambient temperatures (November)

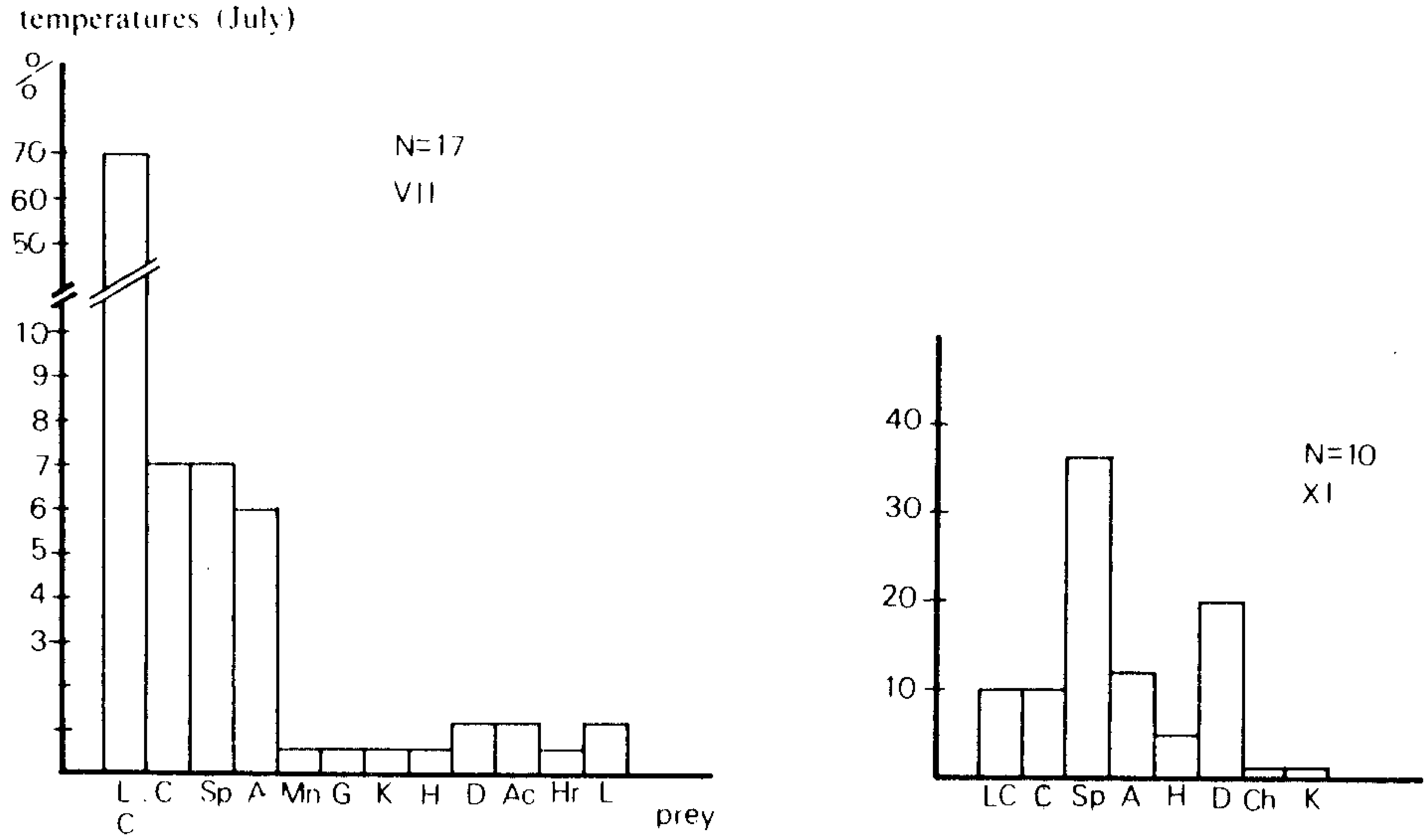

Fig. 1. Percentage of food items found in stomachs of 17 geckoes collected in July (VII) and 10 geckoes collected in November (XI).

LC: larvae of Coleoptera, C: Coleoptera, Sp: spiders, Mn: Mantidae, G: Gastropoda, K: Collembola, H: Hymenoptera, D: Diptera, Ac: Acarea, Hr: harvestmen, L: Larvae, Ch: Chilopoda, A: ants.