THE INSECTS AND RELATED TERRESTRIAL ARTHROPODS OF BALLONA

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INTRODUCTION AND LITERATURE SURVEY

The present study of the ecological condition of Ballona Creek Region ("BCR") is unusual in that it includes insects. For convenience, we use the term insect to refer to arachnids and other groups of terrestrial arthropods as well as true insects (Class Insecta). Although these animals are an important ecological component of terrestrial and freshwater ecosystems, they are seldom considered in environmental impact reports, even though insects are near the base of most food chains and interact with almost all life forms in natural land communities. They are essential food sources for birds and other vertebrates; they control vegetation and population numbers of other animals, including rodents and injurious insect species; and most importantly, they pollinate flowering plants, thus insuring their reproduction (Orsak, 1978). However, insects receive little attention by urban planners and natural resource managers because of their small size, the extreme difficulty in identifying most species and the incorrect assumption that they are biologically and ecologically insignificant.

Some insects are adapted for living only in close proximity to the ocean. They may require saline or sandy conditions or may feed on salt-loving plants (halophytes). Although often observed in large numbers in

suitable habitats, such as salt marshes and coastal sand dunes, they are extremely sensitive to contact with man. The last fifty years has seen a tremendous urban expansion along the California coast, with a concomitant decline of all coastal wildlife, including insects, but very little is known of the specific causes and effects of their loss. Moore and Legner (1972, 1974) and Nagano (1981) have described insect habitat destruction and the need for further study of coastal entomology.

Increased awareness of the destruction of coastal environments has inspired new interest and publication of knowledge about insects living in salt marshes, sand dunes and other marine littoral habitats. The majority of literature on coastal insects has dealt with localities in parts of the world other than California (Gustafson and Lane, 1968; Gustafson, Lane and Lee, 1973), especially eastern North America (Arndt, 1914; Metcalf and Osborn, 1920; Saunders, 1966; Smalley, 1960; Brown, 1940; Davis and Gray, 1969), specific taxa of insects (Cheng, 1976; Doyen, 1976; Nagano, in press; Brown, 1948; Moore, 1956, 1964; Moore and Legner, 1973) or on coastline habitats other than salt marshes (Benedetti, 1973; Craig, 1970; Evans, 1968; Kompfner, 1974; Saunders, 1928).

The intertidal insects of California are treated comprehensively only in identification guides by Evans (1980) and Doyen, Schlinger and Daly (1975). The first of these works dealt primarily with species that inhabit open beaches, and the latter only with the central California coast.

Lane (1969) made the first study of the insects of a California salt marsh on a locality in east San Francisco Bay. He used a variety of collecting methods and found flies and true bugs to be the most abundant. Later, Cameron (1972, 1976) investigated the trophic levels and effects of tides in a salt marsh in San Pablo Bay. The butterflies of Suisun Marsh in Solano County

were surveyed by Shapiro (1974, 1976), who found 43 species. However, it is important to note that Suisun Marsh is approximately 440,000 acres in size, versus the approximately 100 acres of BCR and is surrounded by relatively undisturbed hills of oak woodland and annual grassland.

The beetles (Minnesang, 1980) and flies (Assis de Moraes, 1977) that inhabit Anaheim Bay have also been surveyed. This is a salt marsh located within the Seal Beach Naval Weapons Station, some forty miles south of Ballona Wetlands. Minnesang (1980) found 114 species of beetles, and Assis de Moraes (1977) collected 97 species of flies. Anaheim Bay is a larger salt marsh habitat than BCR.

As with BCR, sand dunes are often associated with salt marshes. Powell (1981) described the condition of coastal sand dunes in California. Although the sand dunes at the west end of Unit 1 were not mentioned, this site has a number of insect species peculiar to the sea coast. He and Nagano (1981) note that this habitat type are among the most rapidly disappearing in the state. Powell and Doyen, of the University of California (Berkeley), have surveyed some of the coastal sand dune systems, especially for beetles and moths (results reported by Powell, 1981). Pierce (Pierce and Pool, 1938) collected on the El Segundo Sand Dunes, a formerly extensive sand dune system extending from the Los Angeles International Airport south to the Palos Verdes Peninsula. However, it is difficult to compare the insects of BCR and the material collected by Pierce, because he concentrated on beetles and largely neglected other taxa, such as bees and wasps. In fact, there has never been a complete survey of the overall insect fauna of a pristine coastal locality in southern California. Unfortunately, the few remaining estuaries, sand dunes and beaches have been so altered by man that it may no longer be possible to determine the nature of the original insect fauna.

As is typical with most environmental impact reports, the one previous study on BCR includes practically no data on insects. The report by Envicom (1979) notes only that the Wandering Skipper (Panoquina errans), an insect considered for Threatened Species status, inhabits the site and that insects and other invertebrates are utilized as food by various species of vertebrates.

Our report could have easily been much larger; however, we have covered the most important aspects of the insect life of BCR for this study. It is obvious that BCR is an oasis for a diverse population of insects and a very important source of information about the insects of the Los Angeles Basin and the southern California coastline.

MATERIALS AND METHODS

The authors made a fully documented collection of insect specimens and associated data of BCR which form the basis for this investigation. A voucher collection of insects is necessary because of the impossibility of identifying most of the species in the field and the need for later verification.

Specialized and comprehensive collecting methods were employed to insure maximum diversity; these included direct capture with aerial, sweep and aquatic nets; trapping with baited pitfall, malaise, yellow pan and ultra-violet light traps; soil sifting to collect subsurface taxa; and Berlese funnel sampling.

The aerial net is used to collect flying and other rapidly moving insects. Sweep nets were used by brushing the net back and forth on shrubbery and other vegetation to capture the insect inhabitants. Aquatic nets were used to dip up insects in streams and ponds.

Baited pitfall traps consist of wide-mouthed jars which are buried in the soil until the opening is flush with the surface of the ground.

Fluids, such as anti-freeze or soapy water, are placed at the bottom of the container. Peanut butter or rotting meat is sometimes used as bait and attractant. The insects fall into the jar where they drown and are preserved in the fluid. These traps could not be used to their full effectiveness in BCR due to theft and vandalism.

Malaise traps are tent-like devices used to capture flying insects. The traps are placed for long periods in a natural flyway, such as a stream bank or on paths through wooded areas. Large and random samples of insects thus are trapped. However, it could not be used as much as desired, again because of vandalism.

Many nocturnal insects are attracted to ultraviolet light, where they can be easily captured. This method uses a 15-watt blacklight suspended over a funnel leading to a bucket containing cyanide, a killing agent. Insects are attracted to the light, fall through to the bucket, where they are overcome by the poison fumes and killed. The ultraviolet light traps were used effectively in several places during the sampling of BCR.

A metal screen was used to shift dirt or sand in order to find subterranean insects. Many of the unique taxa from the sand dunes of Unit 1 were captured with this method.

The Berlese funnel consists of a 40-watt light bulb suspended over a leaf litter sample in a large metal funnel. The heat from the lamp drives the insects down until they fall into a jar of alcohol placed under the spout of the funnel. With this method, many types of minute or secretive insects otherwise overlooked can be captured.

Insect specimens were killed and preserved as appropriate in alcohol or on pins. Each specimen was labelled and given a code number. The latter keys it to ecological data recorded on a data form (Fig. 1) designed for

Figure 1

Every collection (record) has an individual number (1) keying it to four kinds of data (which can be transferred to any number of IBM cards): ecology, host information, insect identification and insect information. Data for each of these is recorded thusly:

Ecology (card): (7) spatial Unit at BCR in which the collection was made; (8-10) macrohabitat, with letter abbreviations as specified by Clark, 1979; (11-16) date; (17-20) time period of capture; (21-40) initials of collectors; (41-50) two-digit habitat codes (01 = plant host, 02 = animal host, 03 = stagnant water, 04 = freshwater, 05 = salt (sea) water, 07 = brackish water, 08 = in soil, 09 = horse dung, 10 = carrion, 11 = dead plant, 12 = under object on ground, 13 = attracted to light, 14 = UV light trap, 15 = Malaise trap, 16 = pan trap, 17 = pitfall trap, 18 = bait trap, 19 = in air, 20 = on top of ground, 21 = sitting on plant or other object, 22 = in animal sign, 23 = Berlese funnel). (51) photograph taken (Y = yes, N = no).

The Host Information (Card) section is used if the insect was collected on plant or animal host. This card has the same record number (1-5) as the Ecology Card. Other data as follows (7-16) family; (17-26) genus; (27-46) species; (47-66) subspecies of the host is recorded; whether the hosts was collected is noted (Y = yes, N = no); and (68-71) the museum catalog number if the host was collected.

Each specimen collected is recorded in the section called Insect Identification (Card). (7-11) family of the organism (first five letters only); (12-31) genus; (32-51) species; subspecies; (72) and a space for a voucher code (s = sighted only; c = collected and preserved; I = seen by person other than the biologists conducting the survey; R = captured and released).

The Insect Information (Card) has the same record number (1-5) as the

Ecology Card. This card accompanies each Insect Identification Card and provides data on each species. (6) It has a card number; (7-16) a two-digit activity code (18 = flying, 19 = crawling, 20 = resting, 21 = found dead, 22 = feeding, 23 = no observations, 24 = mating, 25 = feeding); (17) whether a photograph was taken (Y = yes, N = no); a single-digit (18) abundance code (1 = single, 2 = few, 3 = numerous, 4 = very numerous, 5 = swarming); if it was collected as an egg (19), nymph (20), larva (21), pupa (22) or adult (23); and a note section of 50 spaces for any additional information.

FIGURE 1

Natural History Museum of Los Angeles County
Ballona Wetlands Survey 1980-1981
ENTOMOLOGY FIELD NOTES
CALIFORNIA: Los Angeles County, Ballona Wetlands

Ecology Card

Record # 1)__ __ __ __ __
Card # 6) 1
Unit # 7)__
Microhab. 8)__ __ __
Date 11)__ __ __ __ __ __
Time 17)__ __ __ __
Collect. 21)__ __ __ __ __ __
27)__ __ __ __ __ __
33)__ __ __ __ __ __
39)__ __
Habitat 41)__ __
43)__ __
45)__ __
47)__ __
49)__ __
Photo 51)__

Host Information Card

Record # 1)__ __ __ __ __
Card # 6)__
Family 7)__ __ __ __ __
12)__ __ __ __ __
Genus 17)__ __ __ __ __
22)__ __ __ __ __
Species 27)__ __ __ __ __
32)__ __ __ __ __
37)__ __ __ __ __
42)__ __ __ __ __
Subspec. 47)__ __ __ __ __
52)__ __ __ __ __
57)__ __ __ __ __
62)__ __ __ __ __
Specimen 67)__
Cat. # 68)__ __ __ __

Insect Identification Card

Record # 1)__ __ __ __ __
Card # 6)__
Family 7)__ __ __ __ __
Genus 12)__ __ __ __ __
17)__ __ __ __ __
22)__ __ __ __ __
27)__ __ __ __ __
Species 32)__ __ __ __ __
37)__ __ __ __ __
42)__ __ __ __ __
47)__ __ __ __ __
Subspec. 52)__ __ __ __ __
57)__ __ __ __ __
62)__ __ __ __ __
67)__ __ __ __ __
Voucher 72)__

Insect Information Card

Record # 1)__ __ __ __ __
Card # 6)__
Activity 7)__ __
9)__ __
11)__ __
13)__ __
15)__ __
Photo 17)__
Abundan. 18)__
Egg 19)__
Nymph 20)__
Larva 21)__
Pupa 22)__
Adult 23)__
Notes 27-72)_____
_____

rapid conversion to a computer-based filing system.

Specimens were identified in the laboratory or sent to specialists. They were analyzed for their ecological significance to BCR. Approximately 10,000 specimens representing 475 species were collected. It is important to note that the identification of many specimens is pending further examination by specialists. 300 hours in the field and over 2000 hours in the laboratory were spent by the senior author on this study.

ENTOMOLOGICAL PERSPECTIVE OF THE BALLONA CREEK REGION

Ballona Creek Region contains one of the few remaining coastal salt marshes left in southern California and thus is an important site for insects specialized for this habitat. It serves as a refugium for insects because of the relatively undisturbed habitats and availability of native vegetation for insects that have been extirpated from other such places on our portion of the California coastline. Because of their relative minuteness, insects can survive in small areas as long as the habitat is not greatly disturbed by urban development, recreation, pesticide or other destructive human use.

BCR was divided into arbitrary spaced geographical units called "Units" for accuracy and ease of reference in the discussions following. See the introduction of this report by Ralph Schreiber for a detailed description of these areas.

UNIT 1

Unit 1 not only holds the greatest diversity of insects, but also the most significant species in terms of rarity or restricted occurrence to the coastline of southern California. A number of such species were collected on the sand dunes located at the extreme west end of Unit 1.

The sand dunes deserve special attention, because, despite their

relatively small size, they have the most species of any single habitat type at BCR. Insects that are rare or restricted to the coastline are found here: Subterranean Sand Dune Beetle (Coelus ciliatus); Dorothy's Sand Dune Weevil (Trigonoscuta dorothea dorothea); Belkin's Horse Fly (Apatolestes belkini); Seashore Robber Fly (Cophura clausa); wingless wasps (Brachycistis species); sand dune cockroaches (Arenivaga species); Panther Fly (Neomydas pantherinus); and several genera of rare bees and wasps (see Species List). Noteworthy among these is the Yellow-faced Bee (Hylaeus punctatus) known elsehwere only from Europe. This is the first time this bee has been found in North America.

The willow strand adjoining the sand dunes supports a number of native insect inhabitants. A species that is widespread in southern California but uncommon is Morse's Shield Back Katydid (Neduba morsei). The willow wood is used as a food source by the Locust Clearwing Moth (Paranthene robinae) and Western Drywood Termites (Incisitermes minor). Other common and widespread insects feed on the willow leaves, such as the leaf beetles (Pachybrachus species and Psyllobora viginmaculata) and various leaf- and stem-mining species (see Species List). The leaf litter under the willow trees provides cover for many species of ground-dwelling insects, such as springtails (Collembola), bark lice (Psocoptera), beetles, silverfish (Thysanura) and mites.

The pickleweed portions of Unit 1 support many insects that are only found in regions with wet saline soils, such as coastal salt marshes and estuaries. The largest populaton of the Wandering Skipper (Panoquina errans) at Ballona is found here. Other pickleweed inhabitants include the Brine Fly (Ephydra riparia); long-legged flies (Dolichopodidae); midges (Chironomidae); Pale Shore Bug (Sadula pallipes); ground beetles (Tachys and Bembidion);

and rove beetles (Staphylinidae). The Frail Springtail (Onychirus debilis) known elsewhere from France and Alaska was collected in the Salt Grass (Distichlis spicata).

The salt marsh flies, ground beetles, rove beetles (especially the genus Bledius) and a population of the Mudflat Tiger Beetle (Cicindela trifasciata sigmoidea) inhabit the mud and salt flats of Unit 1. All of these insects spend a portion of their lives burrowing in the saline mud.

Horse stables are located in the southwestern corner of Unit 1. It is important to recognize the great damage to the ecosystem inflicted by the horses and the abundant pest flies (Calliphoridae and Muscidae) whose larvae develop in horse droppings. These flies may be involved in mechanical disease transmission and are known nuisances.

The weedy portions of Unit 1 support numerous species of insects. These are widespread and common types adapted for existence in fallow fields and vacant lots. Introduced insects, such as the Cabbage Butterfly (Pieris rapae) and the Argentine Ant (Iridomyrmex humilis) are the most conspicuous.

Several species of aquatic insects are found in the numerous fresh and brackish waters of Unit 1. The most abundant species is the Salt Marsh Water Boatman (Trichocorixia reticulata) which is probably a significant food source for shorebirds and fishes (Nagano, 1981).

The large number of species of insects inhabiting Unit 1 can be attributed to the numerous species of native plants which provide food and the varied habitats available.

UNIT 2

There are three basic insect habitats in Unit 2: pickleweed, weedy fields and eucalyptus grove. Many of the insects are the same as Unit 1 except that the diversity and abundance is lower.

The salt marsh vegetation (pickleweed and saltgrass) supports a large population of the Wandering Skipper (Panoquina errans). Numerous individuals and mating pairs were observed throughout this habitat. Brine Flies (Ephydra riparia), the Pale Shore Bug (Sadula pallipes), the Mudflat Tiger Beetle (Cicindela trifasciata sigmoidea) and the ground and rove beetles observed in the pickleweed of Unit 1 were also found here. Although Unit 2 has a smaller amount of pickleweed and saltgrass than Unit 1, it still supports viable and healthy populations of salt marsh insects.

The brackish water is inhabited by aquatic insects such as the Salt Marsh Water Boatman (Trichocorixia reticulata) and small water scavenger beetles (Tropisternus species).

The weedy field portion is inhabited by common and widespread insects that feed, breed and develop here. Although common, these insects are an important part of the BCR ecosystem that provide food for vertebrates and perform other essential roles.

The extensive stand of eucalyptus and other introduced plants on the south side of Unit 2 is inhabited by a few insects that are common and widespread in western North America. These include overwintering Monarch Butterflies (Danaus plexippus), Mourning Cloak Butterflies (Nymphalis antiopa), Argentine Ants (Iridomyrmex humilis) and Black Widow Spiders (Lactrodectus mactans hesperus). The depauperate insect fauna can be attributed to the lack of an abundance of native plants at this site. It is a historical fact that few, if any, Australian insects were introduced originally with eucalyptus, and few native North American species have adapted to it as a food host. Essential oils also give the foliage a natural resistance to insect feeding.

UNIT 3

The insect life found in Unit 3 is representative of the coastal strand

and the greater Los Angeles Basin rather than exclusively coastal wetlands. Although it does not have as great a diversity of species as Unit 1, it does have large populations of a few native insect species. Many of these are now very rare or extinct from the coastal regions of Los Angeles County due to habitat destruction and urban growth.

The majority of the vegetation of Unit 3 is pickleweed, scrubland (weedy or fallow field) or transtitional between the two. The many weedy and introduced plants support few species of insects; none were observed on the Pampas Grass (Cortaderia atacamensis). Adult Rabbit Bot Flies (Cuterebra lepivora) were seen and collected in the scrubland; this is an endoparasite of the rabbit populations at BCR.

A nest site of approximately 300 Common Sand Wasps (Bembix americana comata) was found in the northeastern corber of the pickleweed portion. These wasps are important predators of flies. A nest site of the Solitary Bee (Diadasia consociata) is located in the middle of the pickleweed. These bees are important pollinators of many of the native plants in Unit 3.

It is important to note that insects that require permanent sources of saline water or mud are not found in the pickleweed portion of Unit 3. These water-dependent species, which do occur in both Units 1 and 2, are the Wandering Skipper (Panoquina errans), Long-legged flies (Dolichopodidae), the Mudflat Tiger Beetle (Cicindela trifasciata sigmoidea), and the Pale Shore Bug (Saldula pallipes). The absence from Unit 3 of these water-dependent species maybe due to the unreliable and unpredictable presence of water, which appears to be ephemeral and occasional in occurrence.

A semideveloped sand dune is found in the southeastern corner of Unit 3 where some dune vegetation occurs. No sand dune insects were seen or collected, and it is unlikely that any inhabit this site. The many rocks in the soil and the fact that the sand has been artificially placed (Schreiber, pers. comm.) may explain their absence.

Unit 3 is used by many people to ride their off-road vehicles (ORV). This is expecially evident in the pickleweed portions where the soil has been severely scarred. For details of the damage to the insect populations by ORVs, seen the Problems and Conclusions Section of this paper.

The only portion of Unit 3 where true moisture dependent insects occur is in the drain ditch on the northeastern corner. Here there are low density populations of the Wandering Skipper (Panoquina errans), the Mudflat Tiger Beetle (Cicindela trifasciata sigmoidea), Brine Fly (Ephydra riparia), long-legged flies (Dolichopodidae) and the Pale Shore Bug (Saldula pallipes).

The value of Unit 3 to native insects lies in the large amount of open space and vegetation which provides food, cover and nesting sites. Very few sites of similar size and ecological diversity are left along the coastline of Los Angeles County.

AGRICULTURAL LANDS

The Agricultural Lands consist of various gabitats, such as the base of the bluffs, Centinela Creek, cultivated fields and grove of introduced vegetation ("the junkyard") located north of Culver Blvd. The majority of the Agricultural Lands supports few species of insects.

The cultivated fields are used for the production of crops and are plowed or are covered by a few weedy species of plants. The marjority of insects found within the agricultural fields are transient or "pest" species. The Gray Hairstreak Butterfly (Strymon melinus pudica) probably feeds on leguminous plants cultivated on the site.

The weedy portions bordering the agricultural fields also support a depauperate insect fauna, consisting of widespread and common species. Bumblebees (Bombus species) and other native bees were frequently observed feeding on flowers.

Centinela Creek Drainage Ditch which runds through the south side of the Agricultural Lands is another important insect habitat at BCR. The water supports squatic insects and also terrestrial species that feed on emergent portions of hydrophytic plants. The Wandering Skipper (Panoquina errans) and the Mudflat Tiger Beetle (Cicindela trifasciata sigmoidea), Pale Shore Bug (Sadula pallipes), Brine Fly (Ephydra riparia) and ground and

rove beetles (Carabidae and Staphylinidae) are found in the ditch from the gas plant east as far as saline water occurs. The population densities of these insects are lower than those in Units 1, 2 or 3.

The vegetation at the base of the bluffs supports an insect fauna typical of weedy fields and the Coastal Sage Scrub community. No unusual or especially rare insects were observed or collected.

The "junkyard" located north of Culver Blvd. has low insect diversity. Several extremely large colonies of the Argentine Ant (Iridomyrmex humilis) were found under the numerous boards, mattresses and other debris, but no rare or unusual species were discovered here.

The fields next to the gas plant road are filled with rain water during the winter and spring months. Numerous species of insects use the temporary plant life that develops then as food, cover and breeding source. Aquatic insects inhabit the water and serve as food for shorebirds.

BALLONA CREEK CHANNEL

The Ballona Creek Channel has very few species of permanent insect inhabitants because of the rocky substrate which prevents most ground-burrowing forms from becoming established, the high spring and winter flood waters which eliminate all but the hardiest species and the lack of diverse vegetation food sources.

Three species of tiger beetles populate the Ballona Creek Channel. Two, the Red Belly Tiger Beetle (Cicindela haemorrhagica haemorrhagica) and the Oregon Tiger Beetle (C. oregona oregona), are widespread in western North America. The third, the Mudflat Tiger Beetle (C. trifasciata sigmoidea), which is also found in Units 1, 2, 3 and a portion of the Agricultural Lands, has been extirpated from most of its range in the United States. Nagano (in press) postulates that the Ballona Creek Channel population of the last species

is highly susceptible to human disturbance and is in danger of being eliminated.

A single nest each of the Honey Bee (Apis mellifera) and the California Harvester Ant (Pogonomyrmex californicus) were discovered on the north bank of the channel. The Honey Bee nest is located in an old storm pipe, and the Harvester Ant colony is found on the ground in a sandy area. Due to the relatively low numbers of Honey Bees observed at BCR, it is highly probable that this is the only colony in the area. This feral insect, through not native, is important in the pollination of the local flowering plants. Commercial hives, however, have been placed in the agricultural area (as of 1 July 1981).

Numerous algae-feeding flies of an undetermined family were observed on the rocks within the intertidal zone. The Hairy Shore Bug (Sadula comatula) also lives beneath debris in the same area. No insects were seen or collected in or on the seawater in the channel.

Aside from these insects, most of the species observed in the channel are feeding on the few weedy plants or are transients. Although this is the only locality where some of these insects are found at BCR, they are not diverse or abundant when compared to other units.

SPECIES LIST

It is impossible to reduce all of the biological data known for the species to occur at BCR into a simple graphic presentation; this is true by reason of the data's complexity and the multiple stages in the life cycles of insects. The Species List is a very general summary of the salient and most important aspects of BCR's insect fauna. Biological and ecological data are presented for each insect species observed or collected at BCR. Bibliographic sources are given, when possible, for data that are unusual or poorly known. The following is an explanation of each category:

1-5. Unit of occurrence: the unit at which the species was found.

Macrohabitat--where the species was seen, collected or known to inhabit:

6. Introduced community: primarily non-native plants, such as the eucalyptus grove in Unit 2.

7. Agricultural: cultivated lands, such as in the Agricultural Unit.

8. Weedy field: mixture of native and non-native plants, such as the portions lacking pickleweed of Unit 3.

9. Salt pan: small areas in the pickleweed that do not support plant life due to extremely high salt levels.

10. Transitional pickleweed: portions that contain both weedy field and pickleweed.

11. Sand dune: coastal sand dune.

12. Fresh water: primarily freshwater plants.

13. Willow: portions with Salix species.

14. Saltflat: extensive flat dry areas of the saltmarsh covered with a crust of salt.

15. Mudflat: muddy non-vegetative portions of the saltmarsh wet by seawater during tides.

16. Pickleweed: portions with Salicornia and associated vegetation.

Occurrence--the resident status of the species:

17. Resident: permanent.

18. Transient: a temporary inhabitant (non-migratory).

19. Migrant: a temporary, migratory inhabitant.

20. Unknown: resident status is unknown.

Season of Occurrence--time of the year when the species is active as adult:

21. Spring: February to May.

22. Summer: June to August.

23. Fall: September to October.

24. Winter: November to January.

Abundance--the approximated population size of the species:

25. Very common: extremely abundant.

26. Common: abundant.

27. Occasional: sparse.

28. Rare: only a few individuals seen or collected.

Autecology--ecological niche of the species (most conspicuous stage, usually adult):

29. Herbivore: feeds on plant matter.

30. Carnivore: feeds on animal matter.

31. Omnivore: feeds on both plant and animal matter.

32. Parasite: feeding on a living organism without immediately causing its death.

Synecology--ecological interactions with other species (especially trophic role):

33. Mammal prey: eaten by mammals.

34. Bird prey: eaten by birds.

35. Reptile prey: eaten by reptiles.

36. Amphibian prey: eaten by amphibians.

37. Fish prey: eaten by fish.

38. Other prey: eaten by animals not listed above.

39. Pest species: insect is known to annoy or cause damage to man or his possessions.

40. Other information.

See Appendix 1 for the list of species from BCR.

TAXA OF SPECIAL SIGNIFICANCE

Some of the insects that have been collected at BCR are outstanding for one reason or other: few collection records exist, they have been or are being proposed for Endangered or Threatened Species status, they have very restricted or reduced ranges, or they represent important populations for the study of biogeography and insect evolution.

1. Belkin's Horse Fly (Apatolestes belkini; Diptera: Tabanidae): A single adult was collected on the sand dunes of Unit 1. Only a half-dozen specimens are known to science. It has been found on coastal sand dunes from Ensenada, Baja California, Mexico to Playa Del Rey, California. At the present time, nothing is known of the biology or ecology of this species, but judging from its closest relatives, it is not a blood feeder. It probably requires the sand dunes for larval development.

2. Mudflat Tiger Beetle (Cicindela trifasciata sigmoidea; Coleoptera: Cicindelidae): This tiger beetle was collected along the Ballona Creek Channel, the salt and mudflats of Unit 1, the muddy portions of the pickleweed next to Culver Blvd. in Unit 2, the Centinela Creek drainage east of the gas plant in the Agricultural Lands and in the slough of Unit 3. Originally it was probably an inhabitant of the Venice Salt Marsh but was exterminated from all but BCR after the nearby Marina del Rey was constructed. Nagano (in press) documented the range reduction of this beetle. It is restricted to coastal areas where it inhabits tidal regions or estuaries. It is now found in only seven of the 31 localities it was known originally to inhabit in the United States.

3. Sand Dune Tiger Beetle (Cicindela hirticollis gravida; Coleoptera: Cicindelidae): Specimens now in the Museum of Comparative Zoology, Harvard University, were collected at Playa Del Rey in 1906. It occurs only on clean,

light-colored sand at the mouths of estuaries or barrier beaches (Nagano, in press). Nagano has examined old topographic maps of BCR and has determined that the only suitable habitat was at the mouth of Ballona Creek. Tiger beetles are very important in marine littoral ecosystems and have been greatly reduced in range in southern California (Nagano, in press). C. hirticollis gravida is now found at only four of 24 localities it was known to have inhabited in southern California (Nagano, in press). This species apparently is extinct from BCR.

4. Wandering Skipper (Panoquina errans; Lepidoptera: Hesperiidae): Large populations of this skipper are found in the saltmarsh portions of Units 1 and 2. Samller populations are found in the slough on the northeast corner of Unit 3 and along the Centinela Creek drainage which runs along the bluffs in the Agricultural Unit. It is found in close association with the larval foodplant, Salt Grass (Distichlis spicata), which grows amongst pickleweed. For reasons unknown, the Wandering Skipper can develop only on Salt Grass that is wet by sea water or in soil that is very moist. This insect is rapidly disappearing from its range because of the continuous destruction of its coastal habitats. It was one of 24 species of California butterflies considered by the federal government for Threatened or Endangered Species status (Donahue, 1975). Nagano is currently studying the present distribution and size of its few remaining populations.

5. Wingless Wasp (Brachycistis species; Hymenoptera: Tiphiidae): Females of this wasp were collected in pitfall traps and males in ultraviolet light traps in the sand dunes of Unit 1. The females in this genus are wingless, very rarely seen and almost unknown from coastal areas. The males possess wings and are attracted to ultraviolet lights at night. Nothing is known of the biology of these animals; the males and the flightless females are so

structurally different that they undoubtedly lead distinct lives.

6. Sun spider (Eremobates new species; Arachnida: Solpugida): These animals were collected in pitfall traps located on the sand dunes of Unit 1. The species collected is new to science and is to be named by a specialist. It is distributed elsewhere in California and is NOT ENDEMIC to BCR. This species is nocturnal and predaceous on other invertebrates.

7. Dorothy's Sand Dune Weevil (Trigonoscuta dorothea; Coleoptera: Curculionidae): This beetle is common beneath native plants in the sand dunes of Unit 1. It is found only on coastal sand dunes from Point Dume south to Orange County (Pierce, 1975). Because of its extremely local occurrence in a fragile disappearing habitat, it might become a candidate for Threatened status.

8. Yellow-faced Bee (Hylaeus punctatus; Hymenoptera: Colletidae): This bee is known only from western Europe and BCR. It might have been accidentally introduced into the wetlands by human agency or it could be a native insect, posing an interesting problem for biogeographers. Numerous specimens were collected on the sand dunes and near the willow grove in Unit 1.

9. Sweat Bee (Lasioglossum species; Hymenoptera: Halictidae): This bee genus is in need of revision, and it is impossible to ascertain if the eight unidentified species of Lasioglossum are new to science or merely unrecognizable with current knowledge.

10. Frail Springtail (Onchiurus debilis; Collembola: Onychiuridae): One of the most interesting and difficult to explain distributions of any insect known, this springtail is found in France, Alaska and BCR (Bellinger, pers. comm.). A single specimen was collected in a Berlese funnel using leaf litter from the saltmarsh of of Unit 1. There are three possible ways Onchyrius debilis could have arrived at Ballona Wetlands: via human transportation, as

a stowaway aboard an airplane or boat; via natural means of transportation, on ocean drift or in sail on the feet of migratory birds; or it may have been a resident of the west coast of North America for hundreds of millions of years, since before continental drift had separated the continents.

INTRODUCED SPECIES

The impact of terrestrial arthropods known to be introduced in natural ecosystems is not fully understood. A common problem when species newly enter a region is a population explosion and intensive competition with the native wildlife. Well-known examples are the Norwegian Rat (Rattus norwegicus) and the Starling (Sturnus vulgaris). Such problems are especially acute in isolated areas, such as nature preserves or islands. Several adventive insects were discovered during this study and their effects assessed as far as possible.

Common Dysderid Spider (Dysdera crocata) is a spider originally native to Europe that specializes on sowbugs for food. It is common throughout BCR, and the impact on native spiders is unknown.

The most abundant insect at BCR is the Argentine Ant (Iridomyrmex humilis) which arrived in Louisiana in 1890 from South America. From the southeastern United States, this species spread to the warmer parts of California where it is now a ubiquitous household pest. It is not unusual to collect 10,000+ individuals in single baited pitfall trap at BCR. The relatively low numbers of native ant species (2) is probably due to the highly aggressive and competitive nature of the Argentine Ant. This ant is displacing native ant species in other areas of southern California as well, such as in the Santa Monica Mountains and on Santa Catalina Island. Further studies on the ecology and biology of this economically important animal are critically needed to determine its effect on native ant species.

Introduced into eastern North America in the nineteenth century, the Cabbage Butterfly (Pieris rapae) has since spread across the continent to the Pacific Coast. It is one of the most common butterflies at BCR. The impact of Pieris rapae on the native butterfly fauna is probably neutral, since the larvae feed on weedy wild mustard (Brassica) and radish (Rhaphanus).

The Honey Bee (Apis mellifera) was introduced to California in the middle of the nineteenth century. It is now found nearly everywhere in the state. Snelling has observed that hives have been recently placed on the Agricultural Lands and the Honey Bee population has dramatically increased. This may lead to the serious problem of the native bees and the Honey Bees competing for a limited number of flowers.

It is not known when the Yellow-faced Bee (Hylaeus punctatus) was introduced to BCR or if it is a native insect. Further studies are needed to determine the ecology and the effect this insect has on the resident bee fauna.

Hylaeus bisinatus is a close relative of the above bee that was collected at BCR. H. bisinatus was introduced to North America in the late nineteenth century and has since spread to most of the United States. The effect on native bees is negligible.

The earwigs (Forficula auricularia and Euborellia annulipes) are species introduced into North America from the Old World. They are well established and common at BCR. The effect of these omnivorous insects on the native fauna is unknown, but they may prey intensively on ground beetle larvae (Carabidae).

ENDANGERED AND THREATENED SPECIES

No species of insects now known to be under state or federal protection have been detected at BCR. Despite intensive searching for both, we found neither the El Segundo Blue Butterfly (Euphilotes battoides allyni), an Endangered Species known only from the El Segundo Sand Dunes, nor the Palos

Verdes Blue Butterfly (Glaucopsyche lygdamus palosverdesensis), a rare subspecies found only on the Palos Verdes Peninsula.

The Globose Dune Beetle (Coelus globosus) was proposed for consideration as Threatened by the Xerces Society (Anon., 1979) but has not been given that official status to date. It occurs in the foredunes bordering nearby Dockweiler State Beach, but there are no records of the species from BCR.

PROBLEMS AND CONCLUSIONS

1. BCR is one of the few localities in Los Angeles County with large populations of coastal insects. BCR is a refugium for many species of insects that were once widespread but are now largely extirpated from the coast. Insects are a critical component of the marine littoral and wetlands ecosystem. They are the primary converters of plant matter to protein and thus provide food for many vertebrates, such as birds, mammals and reptiles.

2. BCR retains populations of insects whose loss of range elsewhere has been or is being documented: Mudflat Tiger Beetle (Cicindela trifasciata sigmoidea) and Wandering Skipper (Panoquina errans).

3. BCR is important for entomogeographical reasons, i.e. explanation of the presence of a bee and a springtail known elsewhere only from Europe and Alaska in the case of the springtail.

4. Horseback riding throughout Unit 1 is very destructive. Intensive animal, human and off-road vehicle traffic is highly detrimental to native animals and plant life (Nagano, 1980, 1981, in press; Powell, 1981; Weaver and Dale, 1978). These activities cause compaction of the soil, crushing subterranean insects and destroying vegetation, removing food and cover. Machines, animals and people step on or drive over and kill insects that are on the surface of the soil. Nagano (1980) noted the numbers of tiger beetles at Border Field State Park in San Diego County was significantly lower in areas

that had large numbers of horseback riders and horses than in areas that were not so used. In the same report, he also noted the importance of restricting human visitors to established trails on the coastal sand dunes of McGrath State Beach in Ventura County in order to minimize the damage to the flora and fauna. Horses in Unit 1 cause the greatest amount of environmental destruction because their numbers are proportionately greater than human and ORV traffic. It has been noted throughout the field work of this study that the horseback riders tend to disregard established trails and prefer traveling through ecologically sensitive portions such as the sand dunes, mudflats and pickleweed. The rich insect life of these habitats will be eliminated if the horses are allowed to continue their unrestricted ravages.

5. The greatest number of insect species restricted to the sea coast are found at the sand dunes at the west end of Unit 1. This site is subject to traffic by large numbers of humans, equines and occasional ORV's. It is highly probable that the insect fauna of the sand dunes will become extinct if this disturbance continues.

6. Another serious problem is the rapid spread of the introduced ice-plant (Carprobotus edulis) in Units 1, 2 and 3. No insects have been observed feeding on the leaves and relatively few species visit the flowers. Bees of the genera Agapostemon and Bombus feed on the pollen and nectar, but it should be noted that these insects are "general" feeders and will use flowers of most any plant. Some spider species use the iceplant as a site for their webs, but they use almost any low-lying plant or other structure for this purpose. Iceplant is spreading rapidly and will soon crowd out a number of native plant species which are intensively used by insects.

7. Pesticides are a well-known threat to insect populations, especially those species sensitive to other deleterious disturbances to their environment.

If these harmful chemicals enter BCR from any adjoining urban development, then many of the native insects could be eradicated. It will be unlikely that the exterminated species will reestablish themselves because of the lack of any proximate salt marshes or estuaries that can provide a source of new immigrants.

8. The amount of sea water is of indirect, though critical, importance to many insects at BCR. Several species of salt marsh flies (Dolichopodidae, Ephydra riparia, Chironomidae) can only develop in moist or wet saline mud. The adults may require high humidity for their well being and for successful mating.

The larvae of the Wandering Skipper (Panoquina errans) can only live on Salt Grass (Distichlis spicata) that is wet by sea water or in soil that is very moist. The larvae of the Mudflat Tiger Beetle (Cicindela trifasciata sigmoidea) are only found in mud or sand at or just above the mean high-tide mark. It is interesting to note that during high tides these burrows are covered by water. Wilson (1974) noted that some riparian species of tiger beetles in the northeastern United States survive being covered by high river waters.

Beetles of the ground beetle genus Bembidion and rove beetles, especially the genus Bledius, are inhabitants of the mud and salt flats of BCR. Both of these families are predaceous on flies and their larvae. Bledius feed on simple algae (Minnesang, 1980).

Pale Shore Bugs (Sadula pallipes) are common inhabitants of the pickleweed, mud and salt flats. These insects are always found near saline water at Ballona Wetlands. Shore bugs are important predators of flies and other invertebrates.

If the tidal flow is increased, it is highly likely that populations of the salt marsh insects will increase.

9. Continued monitoring of the insect life of BCR is essential. We are still finding species unrecorded from the locality and Los Angeles County on each field trip. We have identified 475 species to date and estimate that as many as 1200 species actually may inhabit BCR.

10. The entomological character of the BCR indicates that it is basically a natural coastal salt marsh and associated sand dune. This conclusion was reached by the presence of insect indicator species of marine coastal habitats, for the marsh--the Wandering Skipper (Panoquina errans), Brine Fly (Ephydra riparia) and Mudflat Tiger Beetle (Cicindela trifasciata sigmoidea); for the dune--Dorothy's Sand Dune Weevil (Trigonoscuta dorothea) and Belkin's Horse Fly (Apatolestes belkini).

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The following specialists identified specimens: Peter Bellinger, California State University at Northridge (Collembola); Ron Leuschner, Manhattan Beach, California (moths); Jim Liebhner, University of California at Berkeley (Agonum); Don Starks, Downey, California (Chrysomelidae); Art Evans, California State University at Long Beach (Scarabaeidae); Eric Fisher, University of California at Riverside (Asilidae); Harry Anderson, Huntington Beach,

California (micro-Hymenoptera); Raymond Gill, California Department of Food and Agriculture (Homoptera); Martin Muma, Silver City, New Mexico (Solpugida); Rowland Shelley, North Carolina State Museum of Natural History (Diploda); and Blaine Hebert, Los Angeles, California (Arachnida). Carol Madle typed the Species List.

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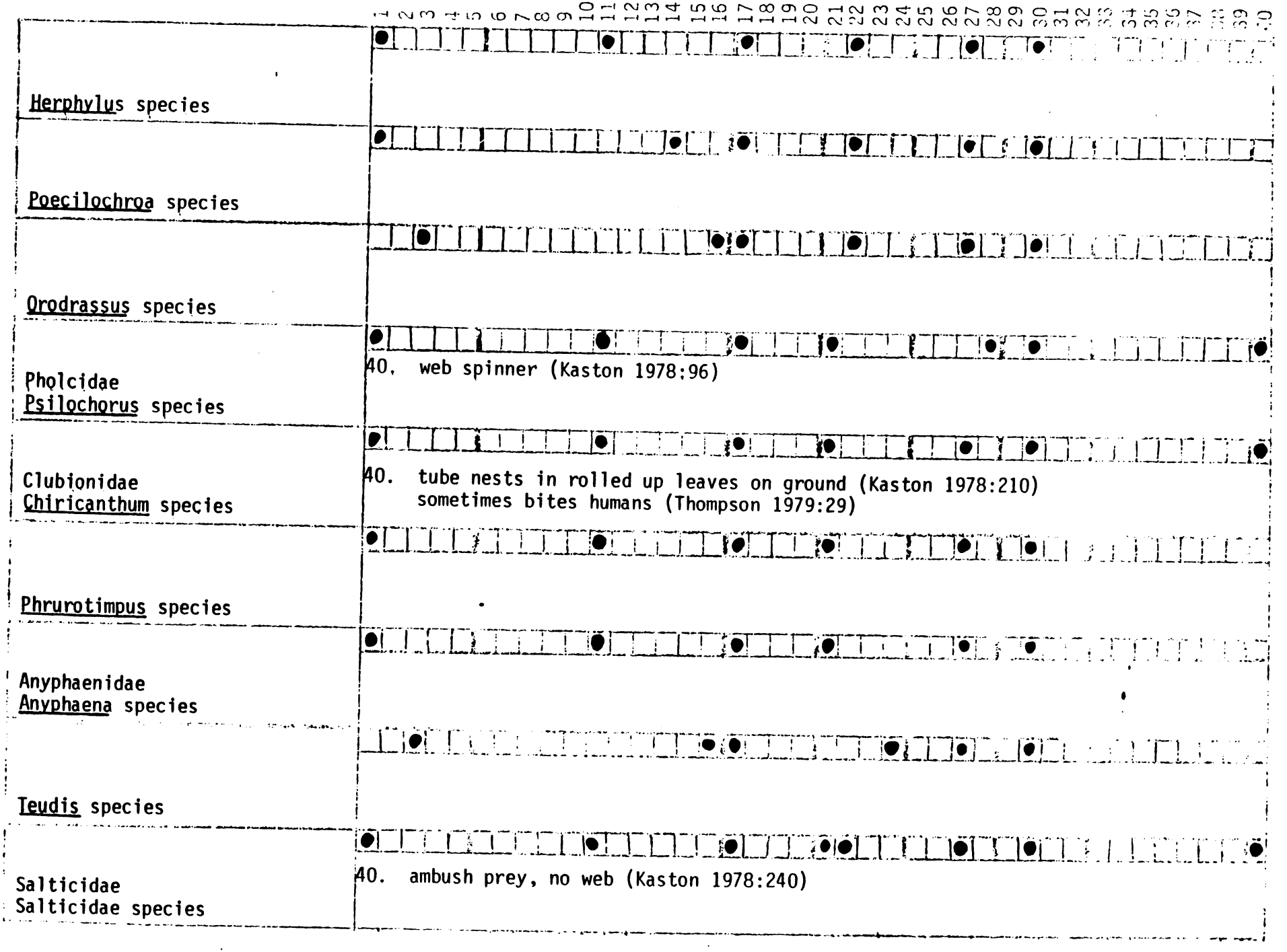
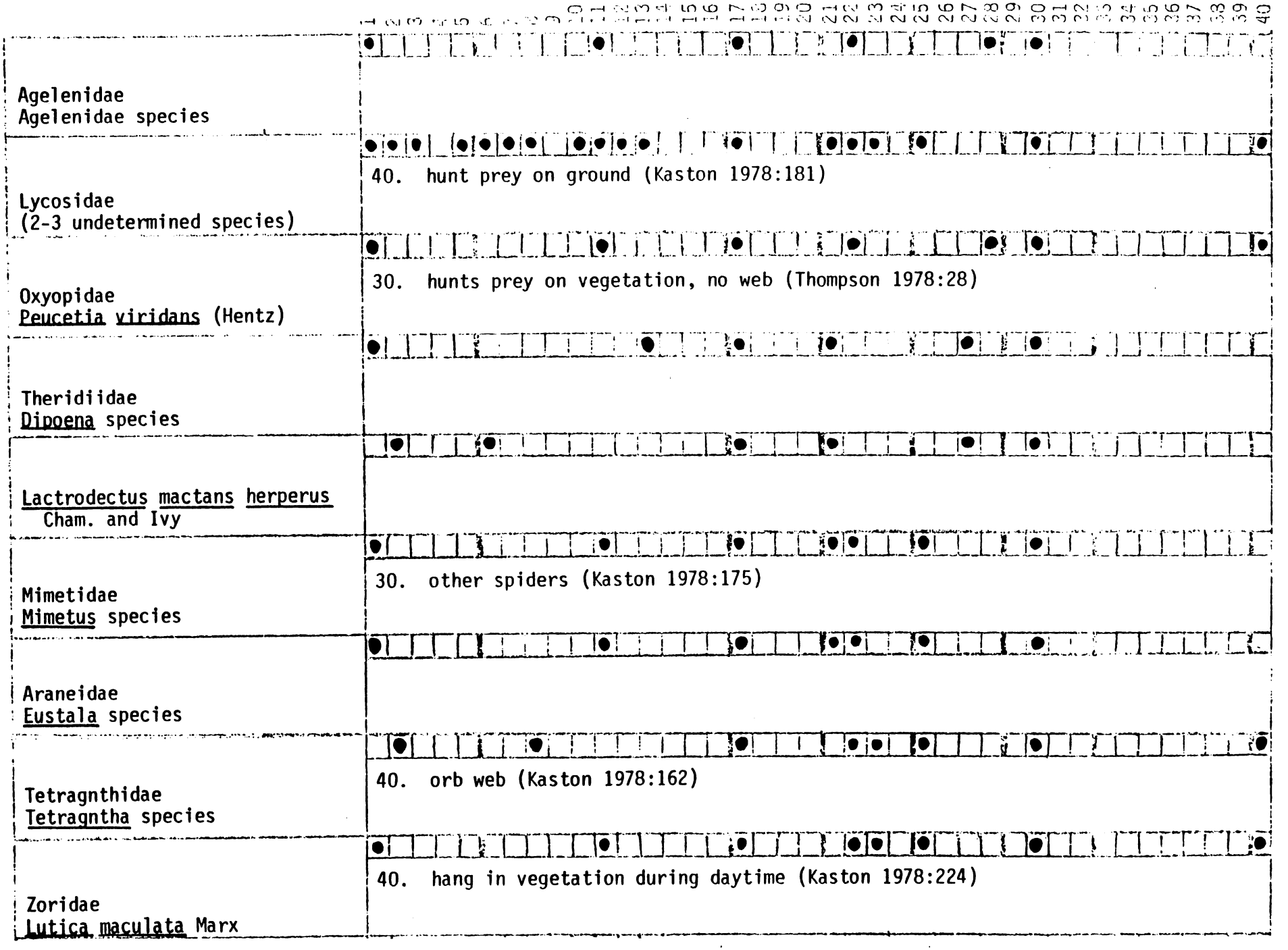
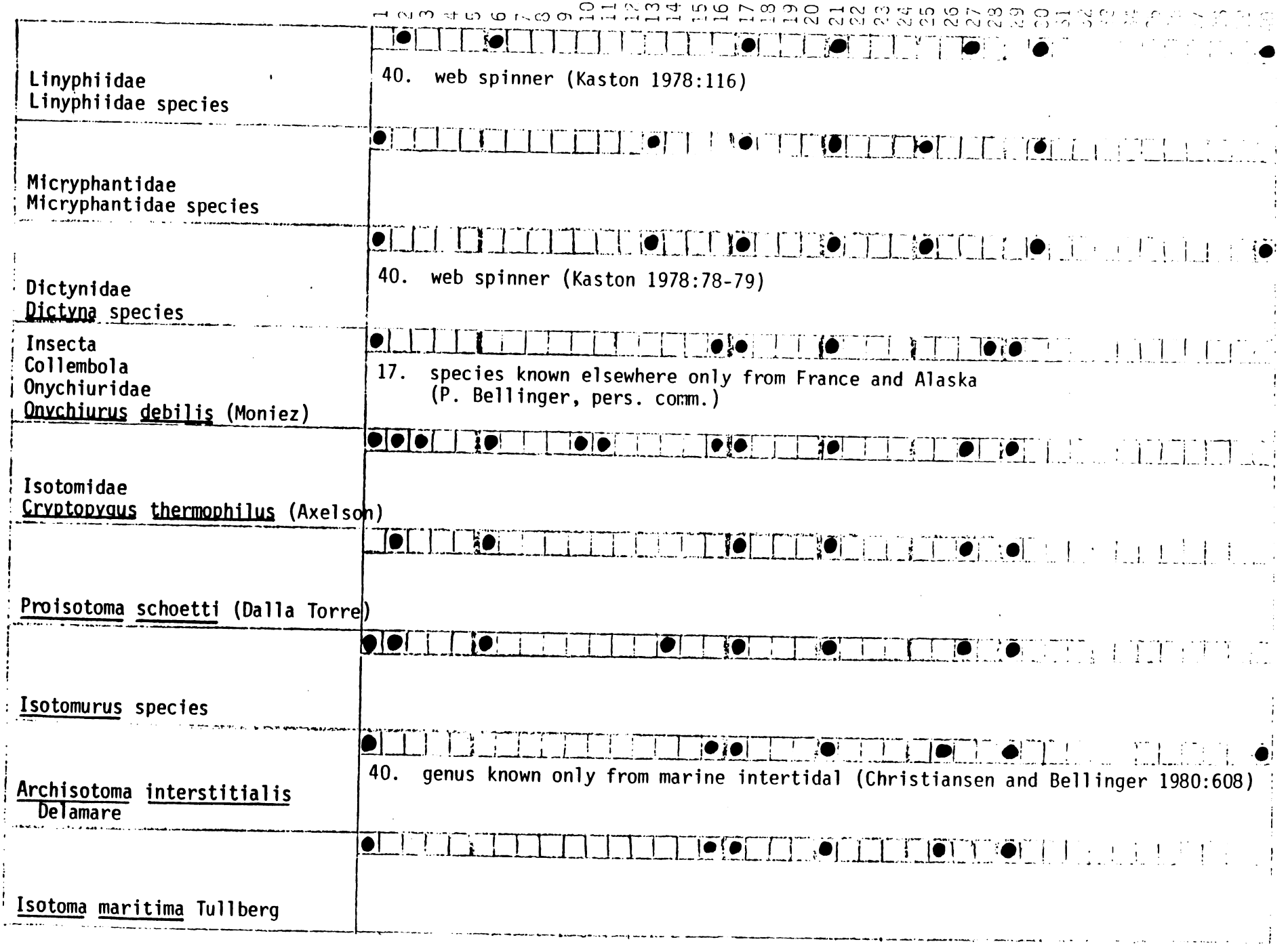
Appendix 1

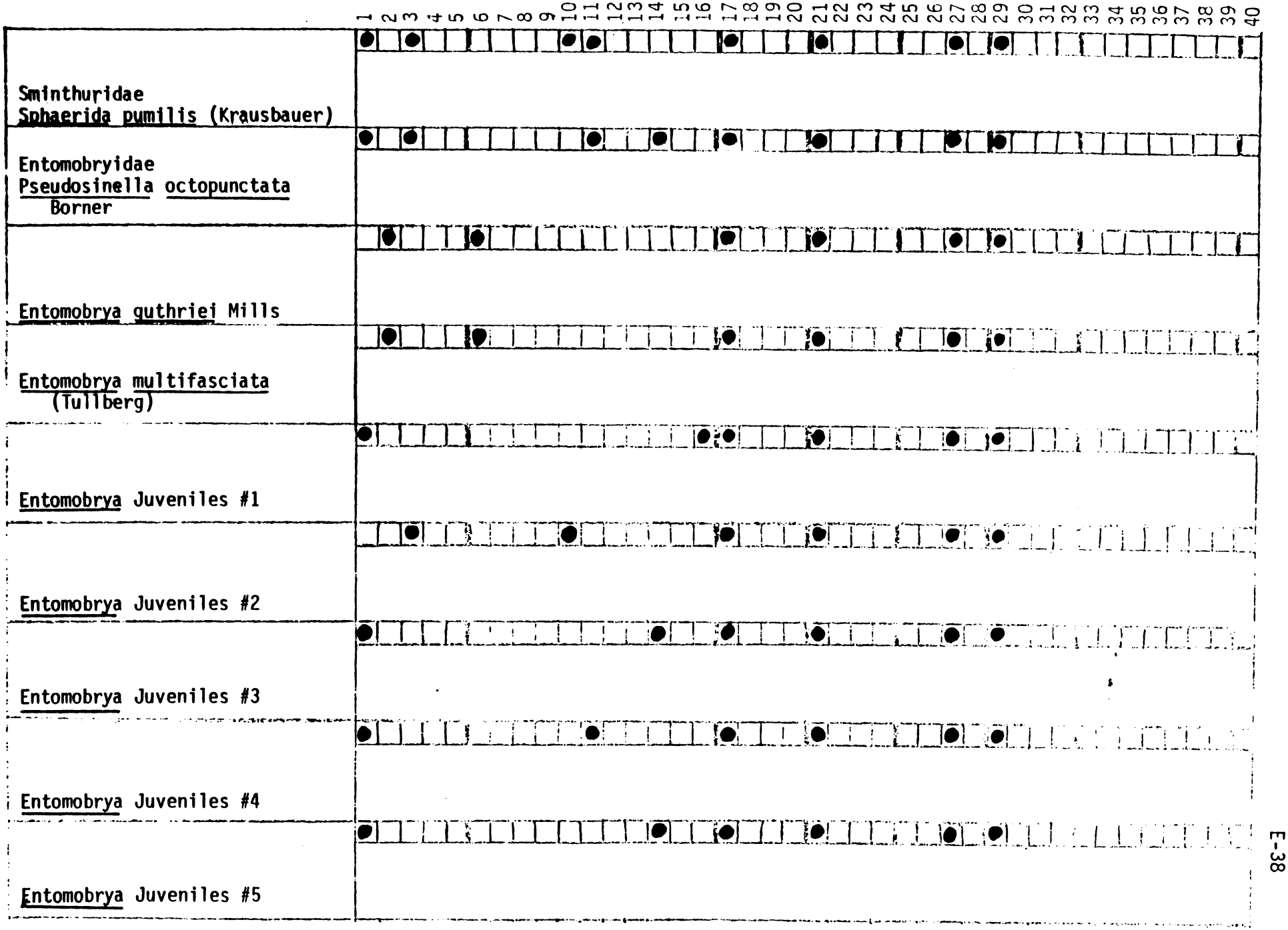
Appendix 1 is the list of species that were found at BCR. For an explanation of the number categories see pages E-13 to E-15.

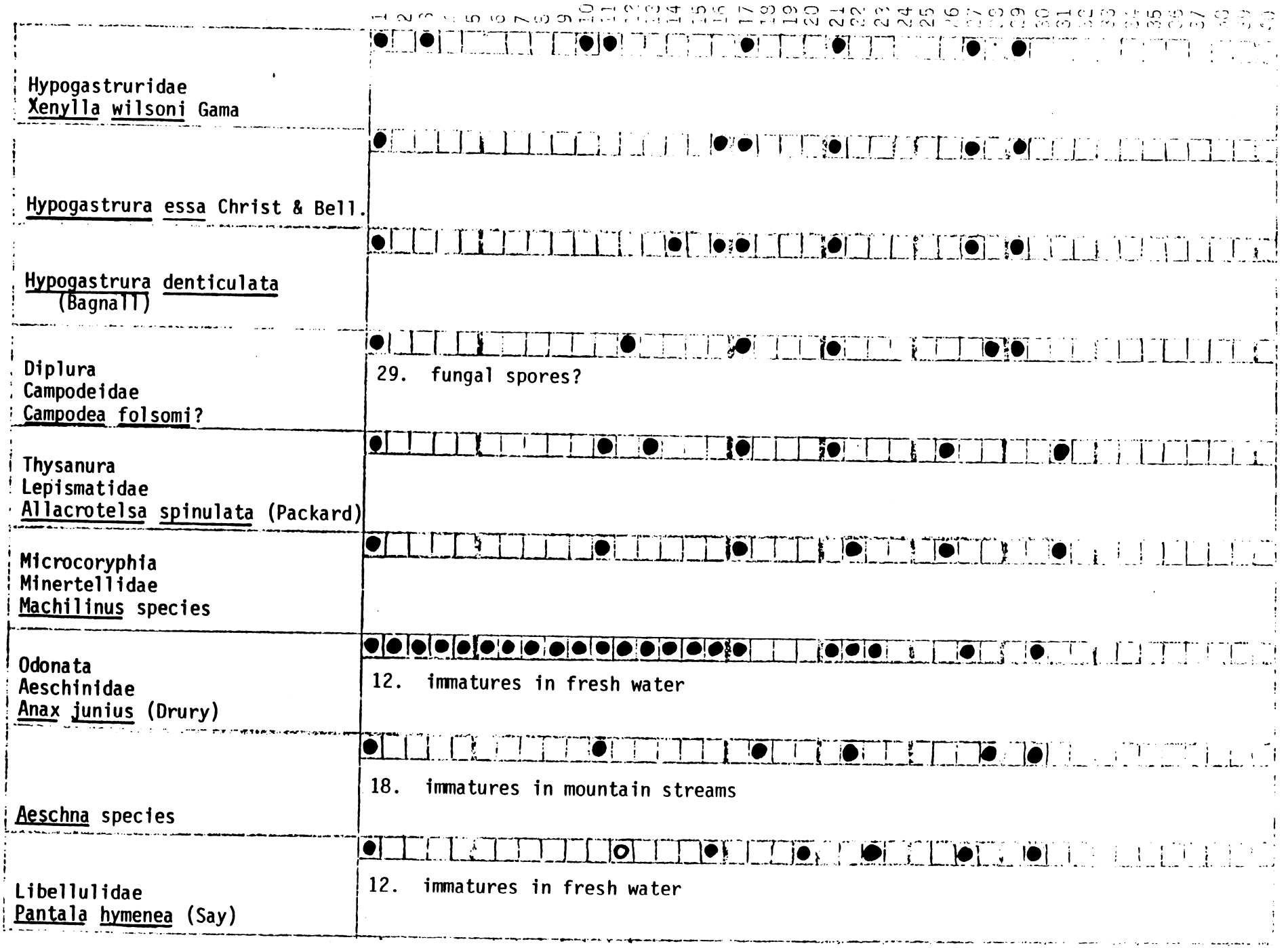
Crustacea Isopoda Oniscidae Armadillidium vulgare (Latr.)	29. decaying plant material and young plants 38. prey of Dysdera crocata
Porcellio laevis Koch	29. decaying plant material and young plants 38. prey of Dysdera crocata
Arachnida Spirobolida Parajulidae Parajulidae species	
Arachnida Solpugida Erematobidae Eremobates new species	17. not endemic
Araneida Ctenizidae Aptostichus species	40. build web-like burrows from which ambush prey (Kaston, 1978:68-72)
Oecobiidae Oecobis species	40. probably lives under stones (Kaston 1978:75)
Dysderidae Dysdera crocata Koch	17. introduced from Europe (Thompson 1979:26) 30. preys on sowbugs (Thompson 1979:26)
Oonopidae Scaphiella hespera Cham.	
Gnaphosidae Zelotes species	40. probably lives in web-lined tube nest from which leaves to hunt insects (Kaston 1978:200)

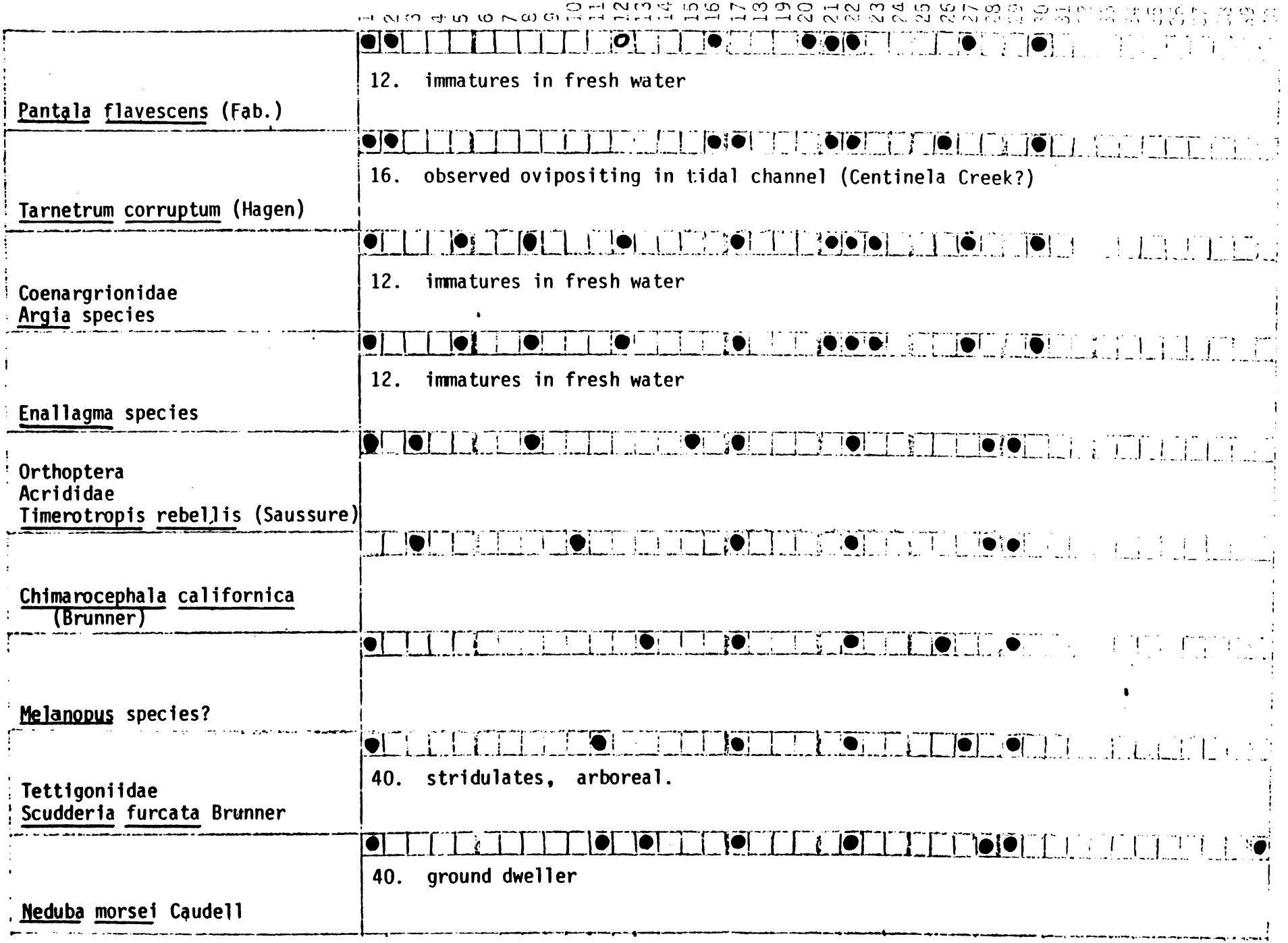

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Herphylus species
Poecilochroa species
Orodrassus species
Pholcidae
Psilochorus species
40. web spinner (Kaston 1978:96)
Clubionidae
Chiricanthum species
40. tube nests in rolled up leaves on ground (Kaston 1978:210)
sometimes bites humans (Thompson 1979:29)
Phrurotimpus species
Anyphaenidae
Anyphaena species
Teudis species
Salticidae
Salticidae species
40. ambush prey, no web (Kaston 1978:240)

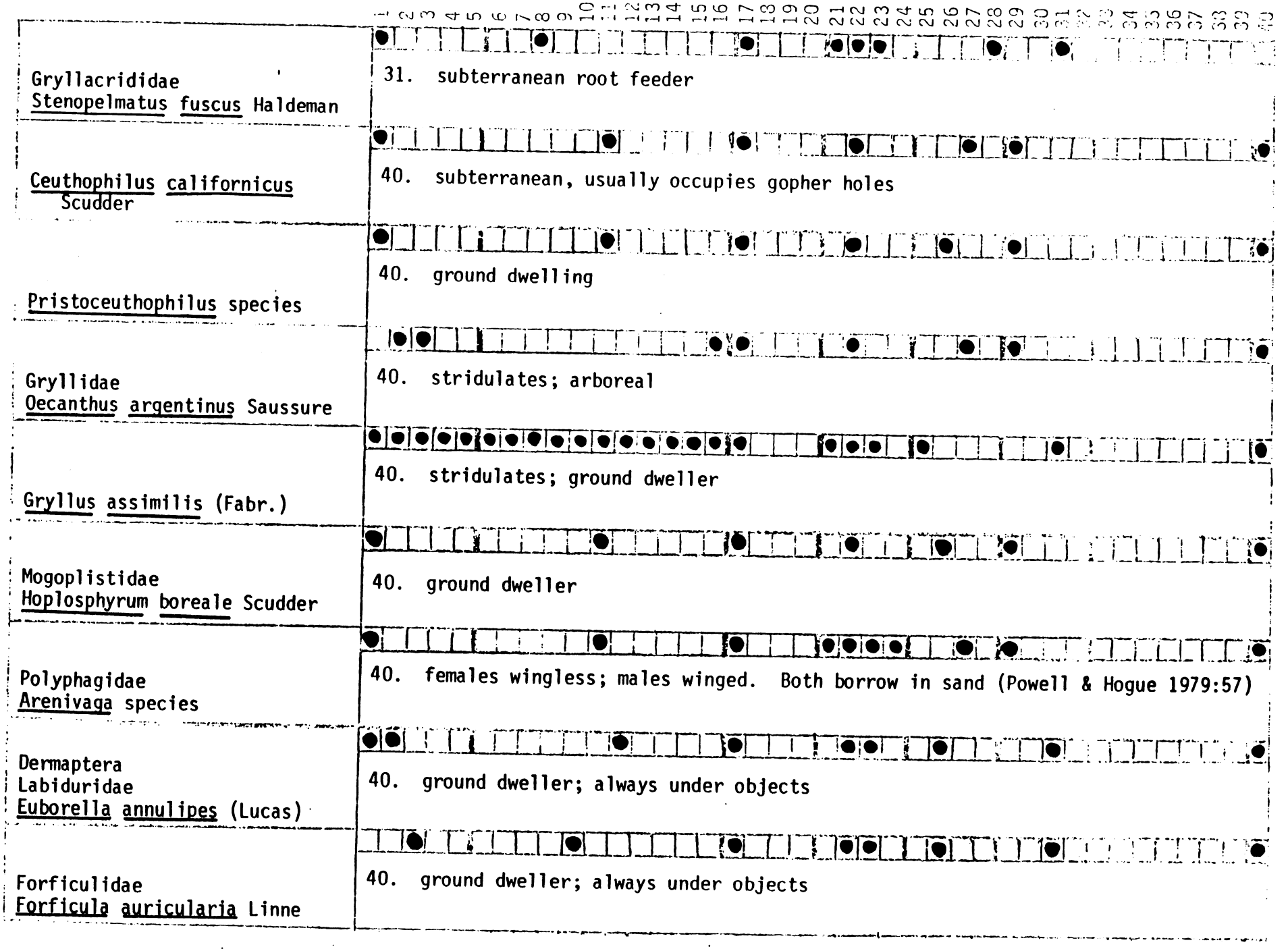

Agelenidae
Agelenidae species
Lycosidae
(2-3 undetermined species)
40. hunt prey on ground (Kaston 1978:181)
Oxyopidae
Peucetia viridans (Hentz)
30. hunts prey on vegetation, no web (Thompson 1978:28)
Theridiidae
Dipoena species
Lactrodectus mactans herperus
Cham. and Ivy
Mimetidae
Mimetus species
30. other spiders (Kaston 1978:175)
Araneidae
Eustala species
Tetragnthidae
Tetragntha species
40. orb web (Kaston 1978:162)
Zoridae
Lutica maculata Marx
40. hang in vegetation during daytime (Kaston 1978:224)

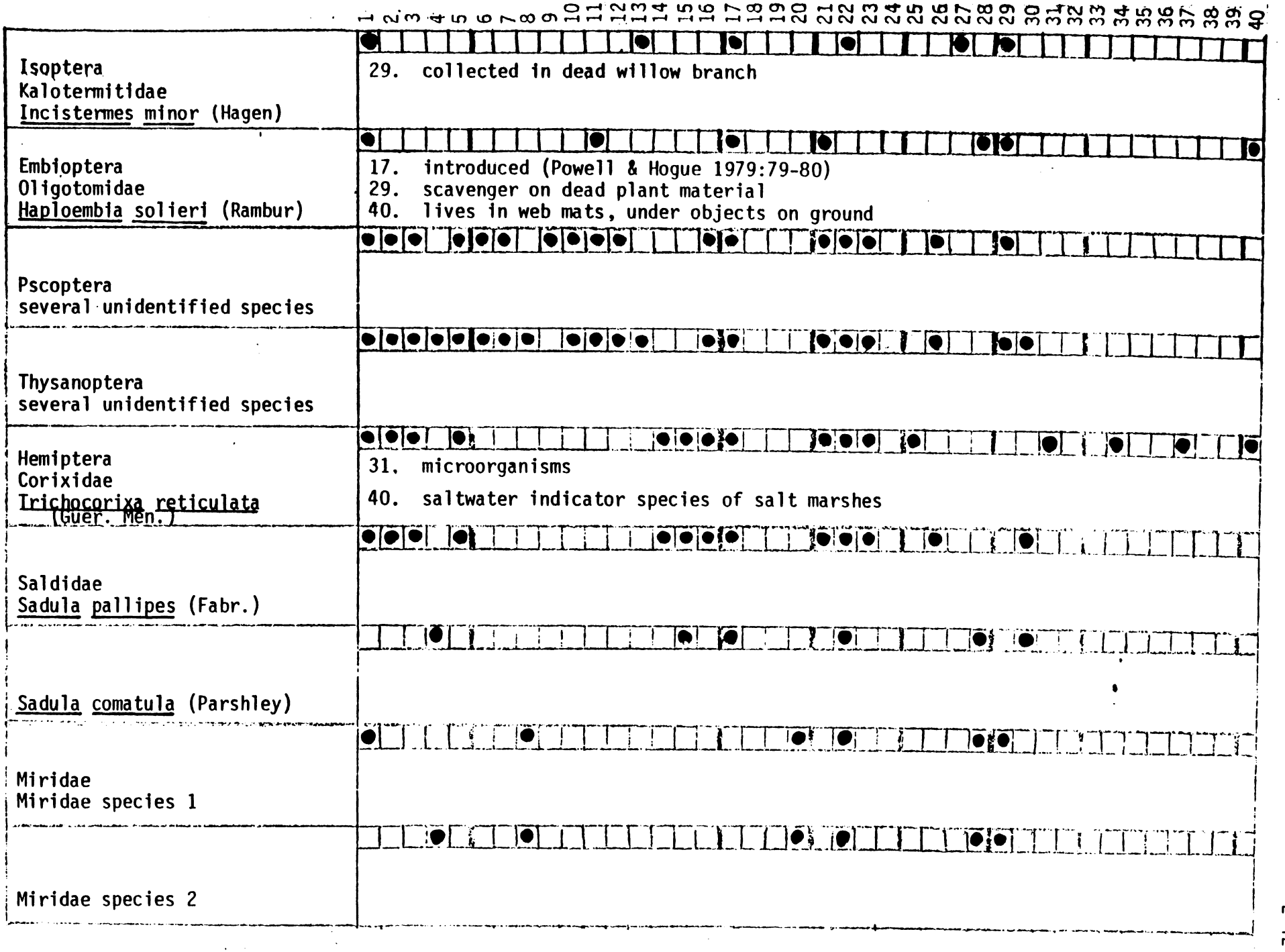

Linyphiidae
Linyphiidae species
40. web spinner (Kaston 1978:116)
Micryphantidae
Micryphantidae species
Dictynidae
Dictyna species
40. web spinner (Kaston 1978:78-79)
Insecta
Collembola
Onychiuridae
Onychiurus debilis (Moniez)
17. species known elsewhere only from France and Alaska (P. Bellinger, pers. comm.)
Isotomidae
Cryptopygus thermophilus (Axelson)
Proisotoma schoetti (Dalla Torre)
Isotomurus species
Archisotoma interstitialis Delamare
40. genus known only from marine intertidal (Christiansen and Bellinger 1980:608)
Isotoma maritima Tullberg

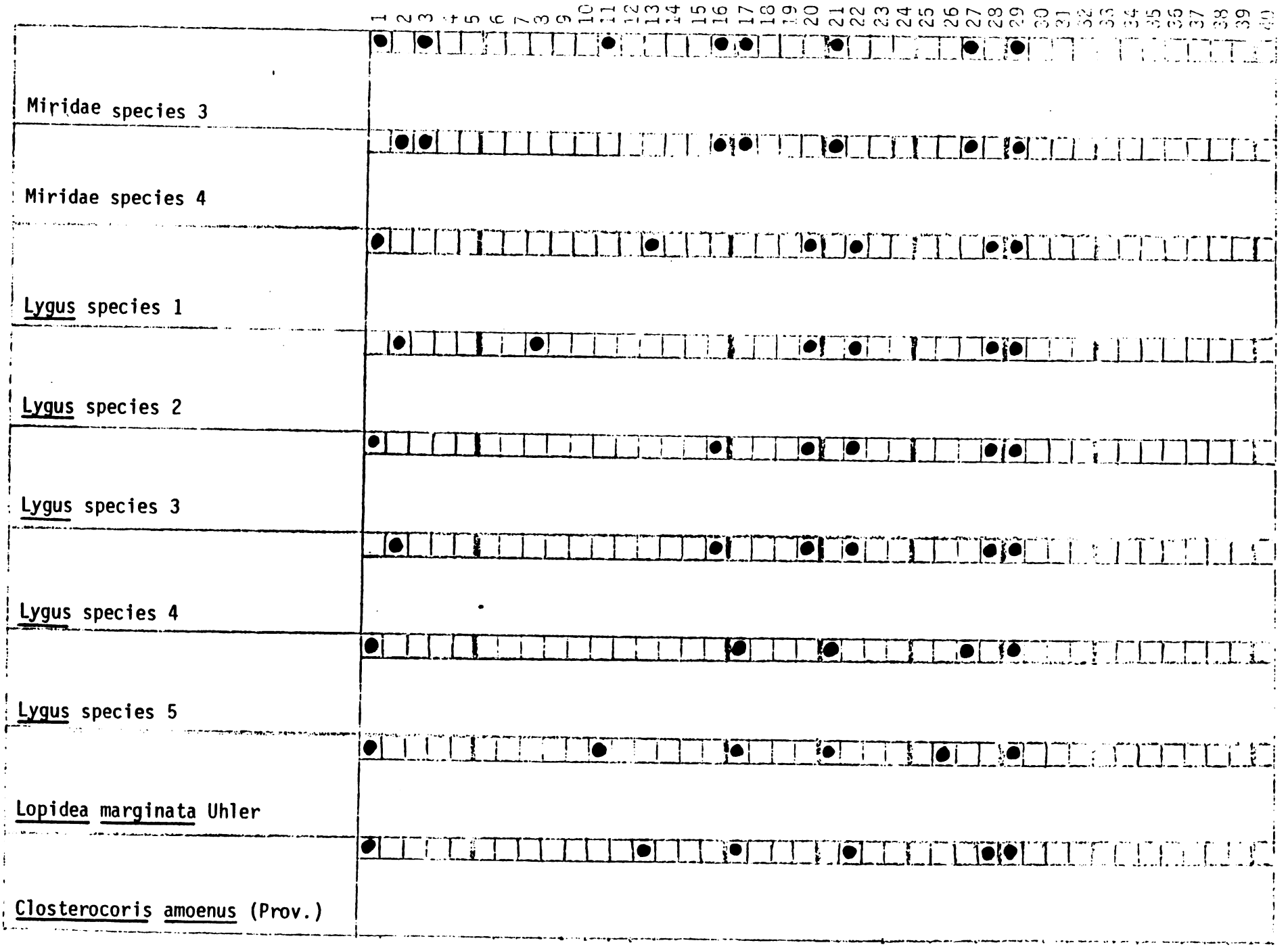

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Sminthuridae
Sphaerida pumilis (Krausbauer)
Entomobryidae
Pseudosinella octopunctata Borner
Entomobrya guthriei Mills
Entomobrya multifasciata (Tullberg)
Entomobrya Juveniles #1
Entomobrya Juveniles #2
Entomobrya Juveniles #3
Entomobrya Juveniles #4
Entomobrya Juveniles #5


Hypogastruridae
Xenylla wilsoni Gama
Hypogastrura essa Christ & Bell.
Hypogastrura denticulata (Bagnall)
Diplura
Campodeidae
Campodea folsomi?
29. fungal spores?
Thysanura
Lepismatidae
Allacrotelsa spinulata (Packard)
Microcoryphia
Minertellidae
Machilinus species
Odonata
Aeschinidae
Anax junius (Drury)
12. immatures in fresh water
Aeschna species
18. immatures in mountain streams
Libellulidae
Pantala hymenea (Say)
12. immatures in fresh water


Pantala flavescens (Fab.)
12. immatures in fresh water
Tarnetrum corruptum (Hagen)
16. observed ovipositing in tidal channel (Centinela Creek?)
Coenargrionidae
Argia species
12. immatures in fresh water
Enallagma species
12. immatures in fresh water
Orthoptera
Acrididae
Timerotropis rebellis (Saussure)
Chimarocephala californica (Brunner)
Melanopus species?
Tettigoniidae
Scudderia furcata Brunner
40. stridulates, arboreal.
Neduba morsei Caudell
40. ground dweller

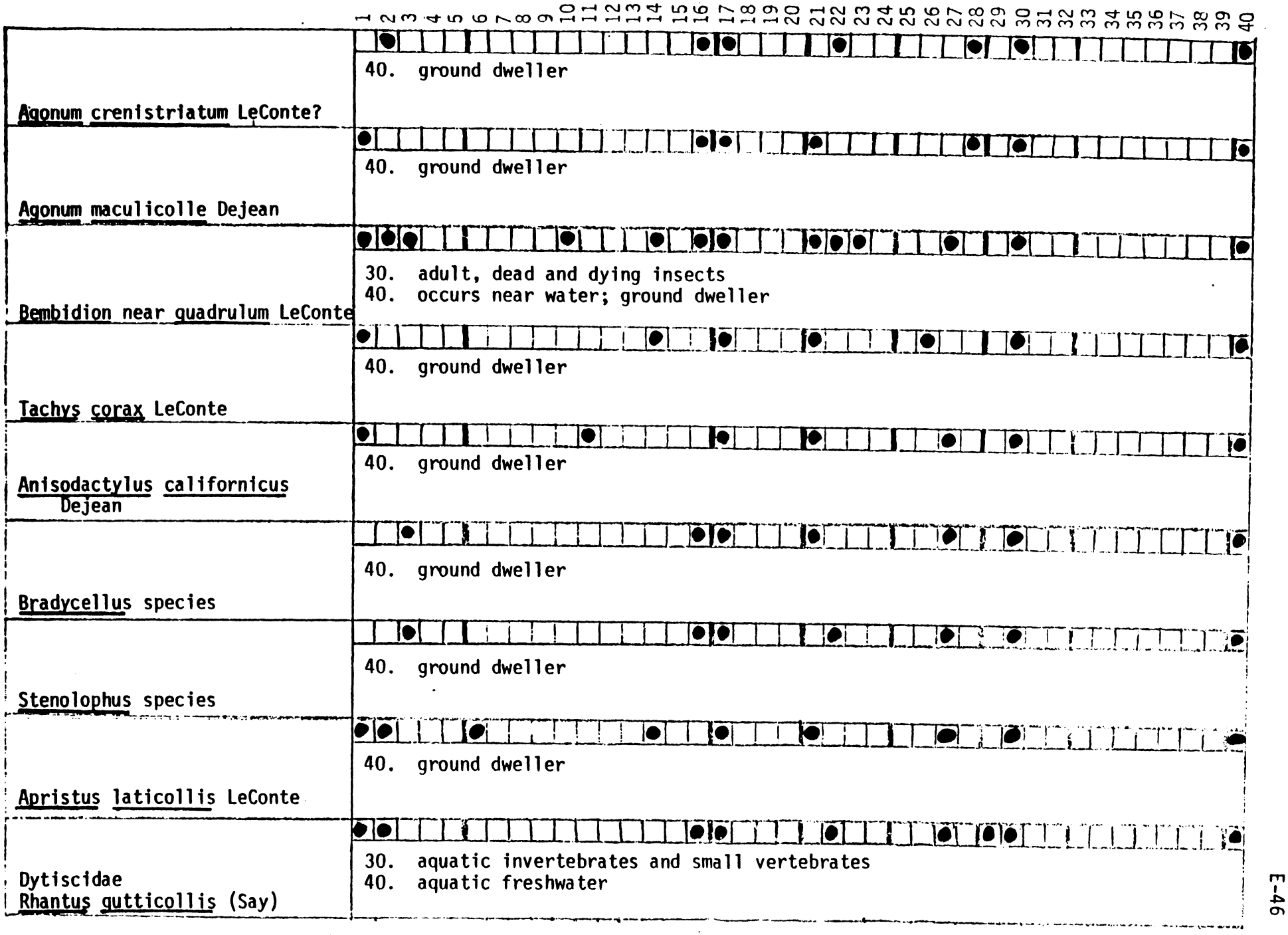

Gryllacrididae
Stenopelmatus fuscus Haldeman
31. subterranean root feeder
Ceuthophilus californicus Scudder
40. subterranean, usually occupies gopher holes
Pristoceuthophilus species
40. ground dwelling
Gryllidae
Oecanthus argentinus Saussure
40. stridulates; arboreal
Gryllus assimilis (Fabr.)
40. stridulates; ground dweller
Mogoplistidae
Hoplosphyrum boreale Scudder
40. ground dweller
Polyphagidae
Arenivaga species
40. females wingless; males winged. Both borrow in sand (Powell & Hogue 1979:57)
Dermaptera
Labiduridae
Euborella annulipes (Lucas)
40. ground dweller; always under objects
Forficulidae
Forficula auricularia Linne
40. ground dweller; always under objects

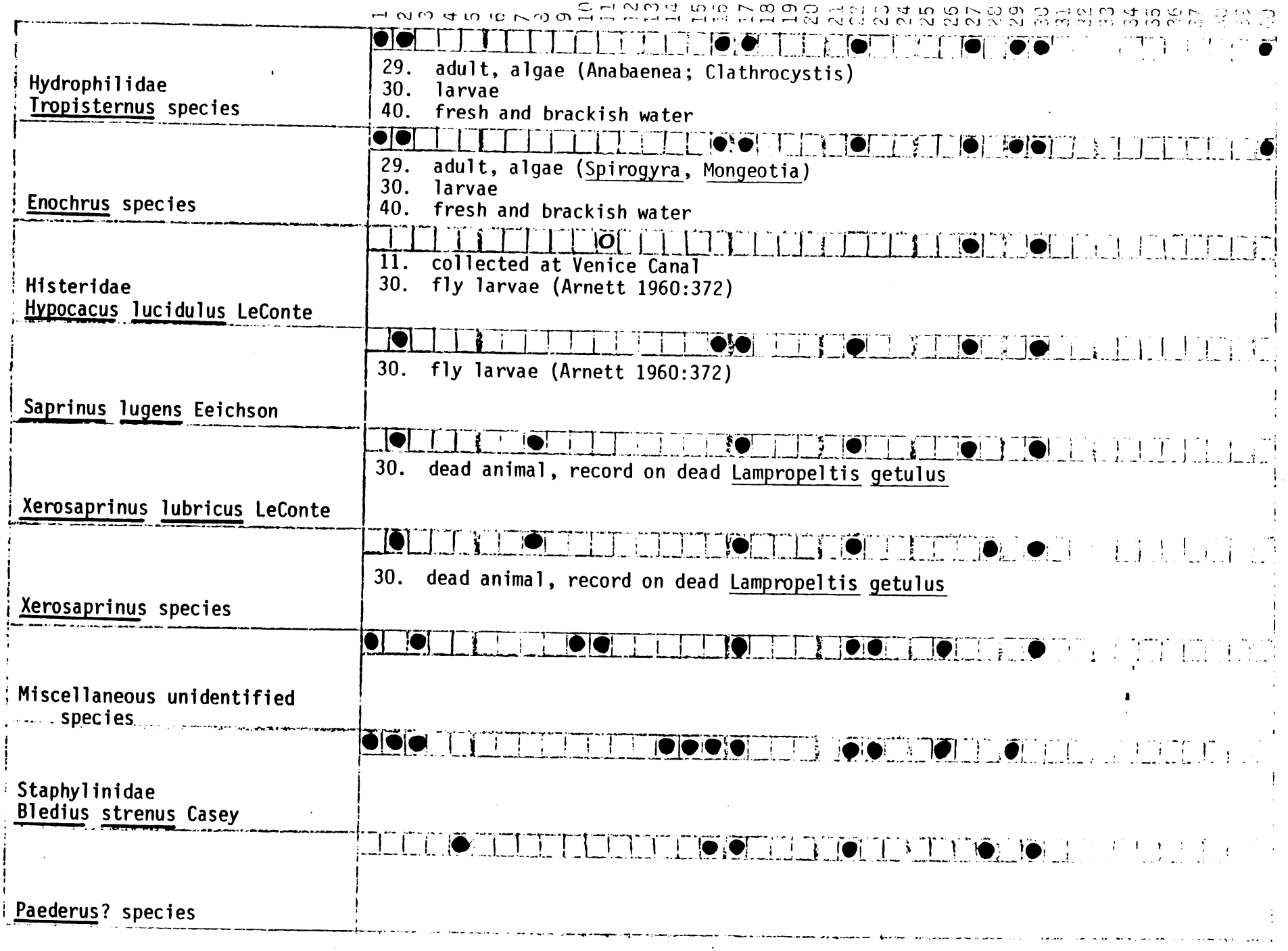

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Isoptera
Kalotermitidae
Incistermes minor (Hagen)
29. collected in dead willow branch
Embioptera
Oligotomidae
Haploembia solieri (Rambur)
17. introduced (Powell & Hogue 1979:79-80)
29. scavenger on dead plant material
40. lives in web mats, under objects on ground
Pscoptera
several unidentified species
Thysanoptera
several unidentified species
Hemiptera
Corixidae
Trichocorixa reticulata (Guer. Men.)
31. microorganisms
40. saltwater indicator species of salt marshes
Saldidae
Sadula pallipes (Fabr.)
Sadula comatula (Parshley)
Miridae
Miridae species 1
Miridae species 2

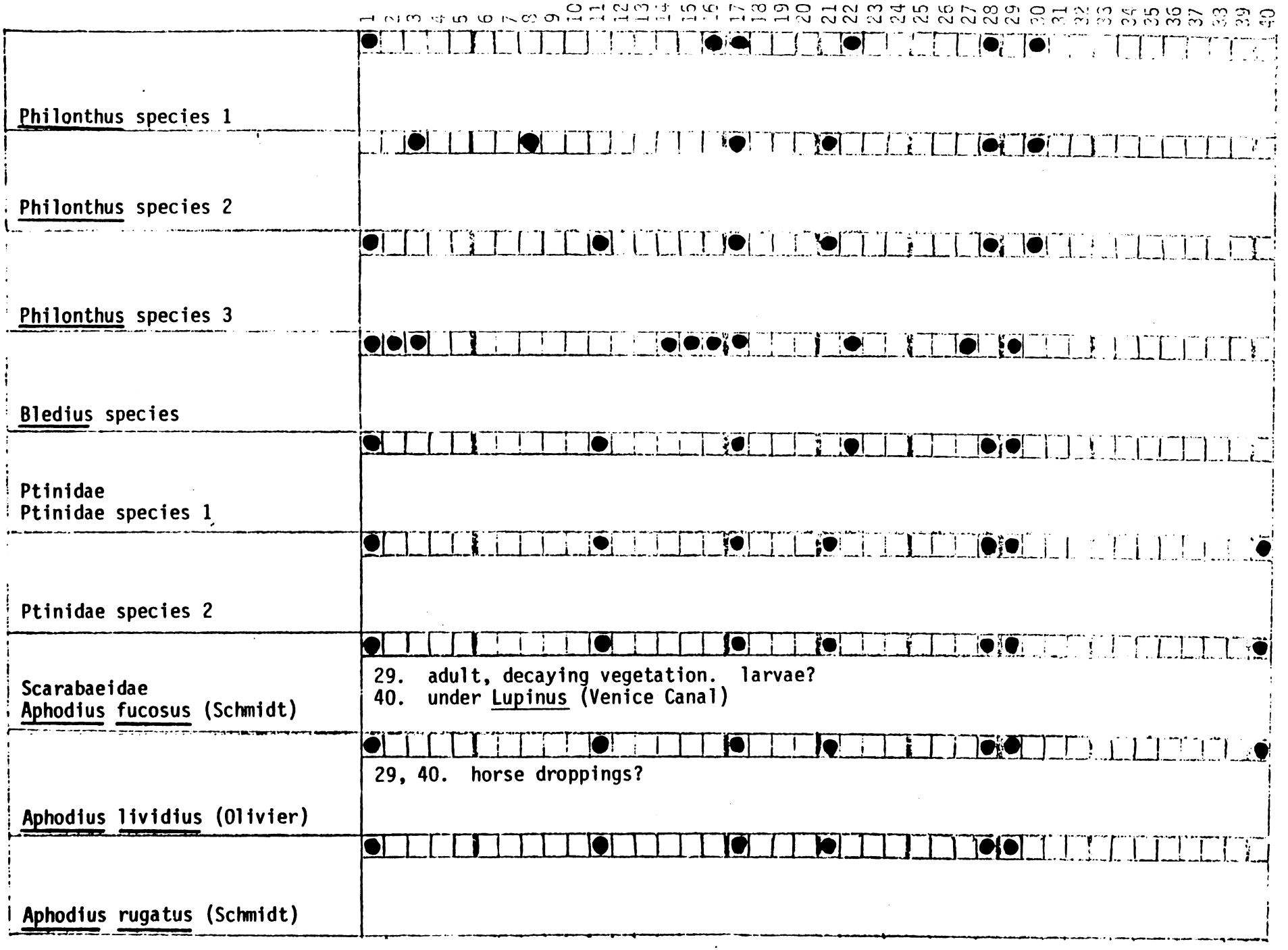

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Miridae species 3
Miridae species 4
Lygus species 1
Lygus species 2
Lygus species 3
Lygus species 4
Lygus species 5
Lopidea marginata Uhler
Closterocoris amoenus (Prov.)

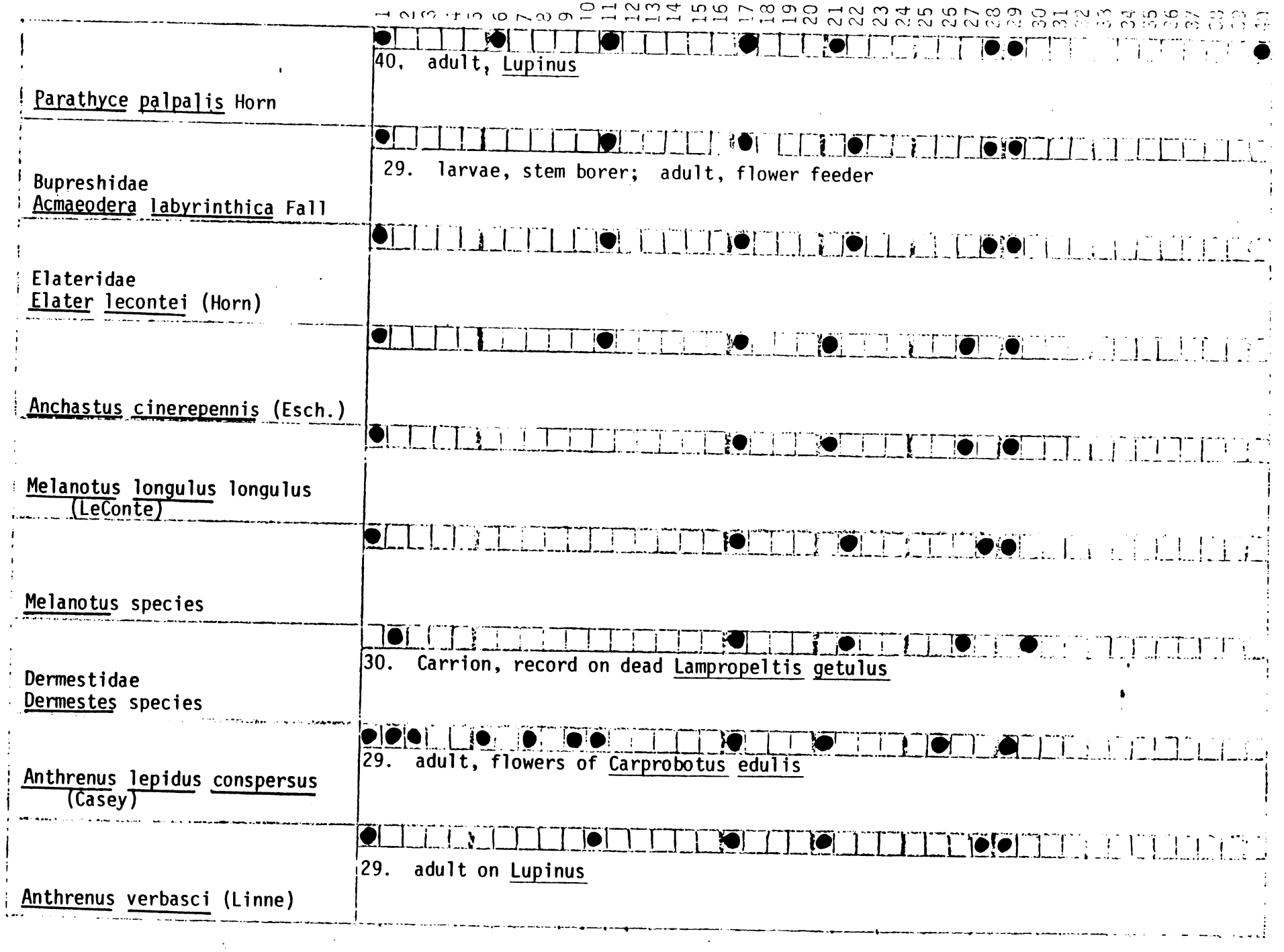
Reduviidae Zelus tetracanthus Stal	30. other insects
Reduviidae species	30. other insects
Pentatomidae Thyanta pallidovirens (Stal)	29. plant sap 40. arboreal
Cydnidae Microporus obliquus Uhler	40. subterranean
Rhytidoporus compactus (Uhler)	40. subterranean
Neuroptera Hemerobiidae Hemerobius pacificus Banks	30. larvae, mites and aphids
Chrysopidae Chrysopa carnea Steph.	30. larvae, other insects 31. adults (honeydew, pollen, sometimes other insects)
Myrmeleontidae Brachynemurus ferox (Walker)	40. Larvae in sandpits (prey traps)
Myrmeleon arizonicus Banks	40. larvae in sand pits (prey traps)

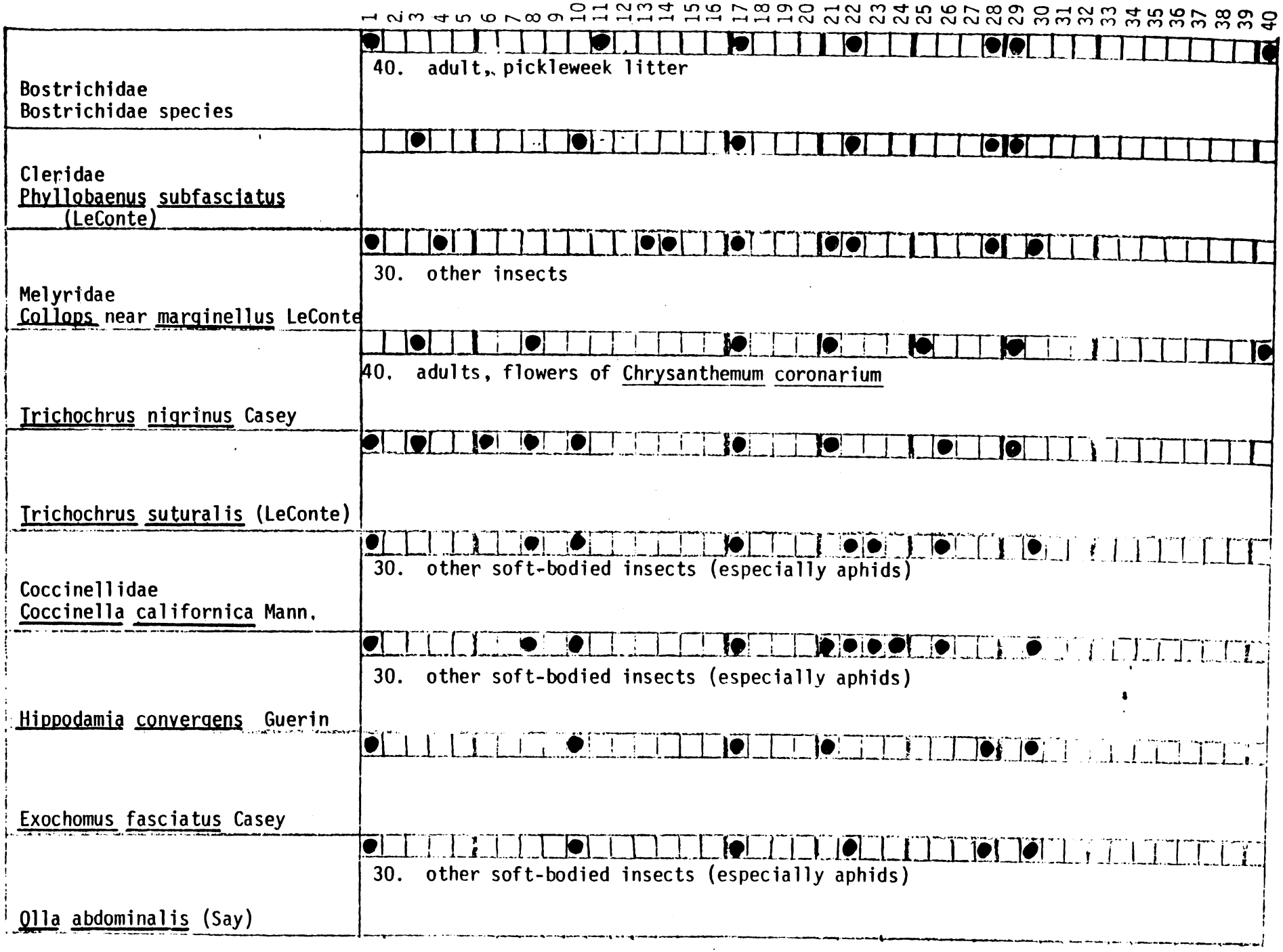
Coleoptera Cicindelidae Cicindela oregona oregona (LeConte)	30. larvae in burrows in mud
Cicindela haemorrhagica haemorrhagica LeConte	30. larvae in burrows in mud
Cicindela trifasciata sigmoidea LeConte	17. Restricted to estuaries and bays on southern California - Baja California. Reduced to 7 localities, threatened? (Nagano, in press)
Cicindela hirticollis gravida LeConte	17. Harvard Museum record, extinct BCR. Reduced to 4 localities in southern California.
Carabidae Pterostichus californicus (Dejean)	35. Anniella pulchra (M Hayes, pers. comm.) 40. ground dweller
Calosoma semilaeve LeConte	30. caterpillars 40. strongly odiferous
Amara californica (Dejean)	29. adults, arboreal 30. larvae 40. large numbers collected in pickleweed at night, Area 3. Ground dweller
Calathus ruficollis ruficollis Dejean	40. ground dweller
Agonum californicum Dejean	40. occurs near water; ground dweller

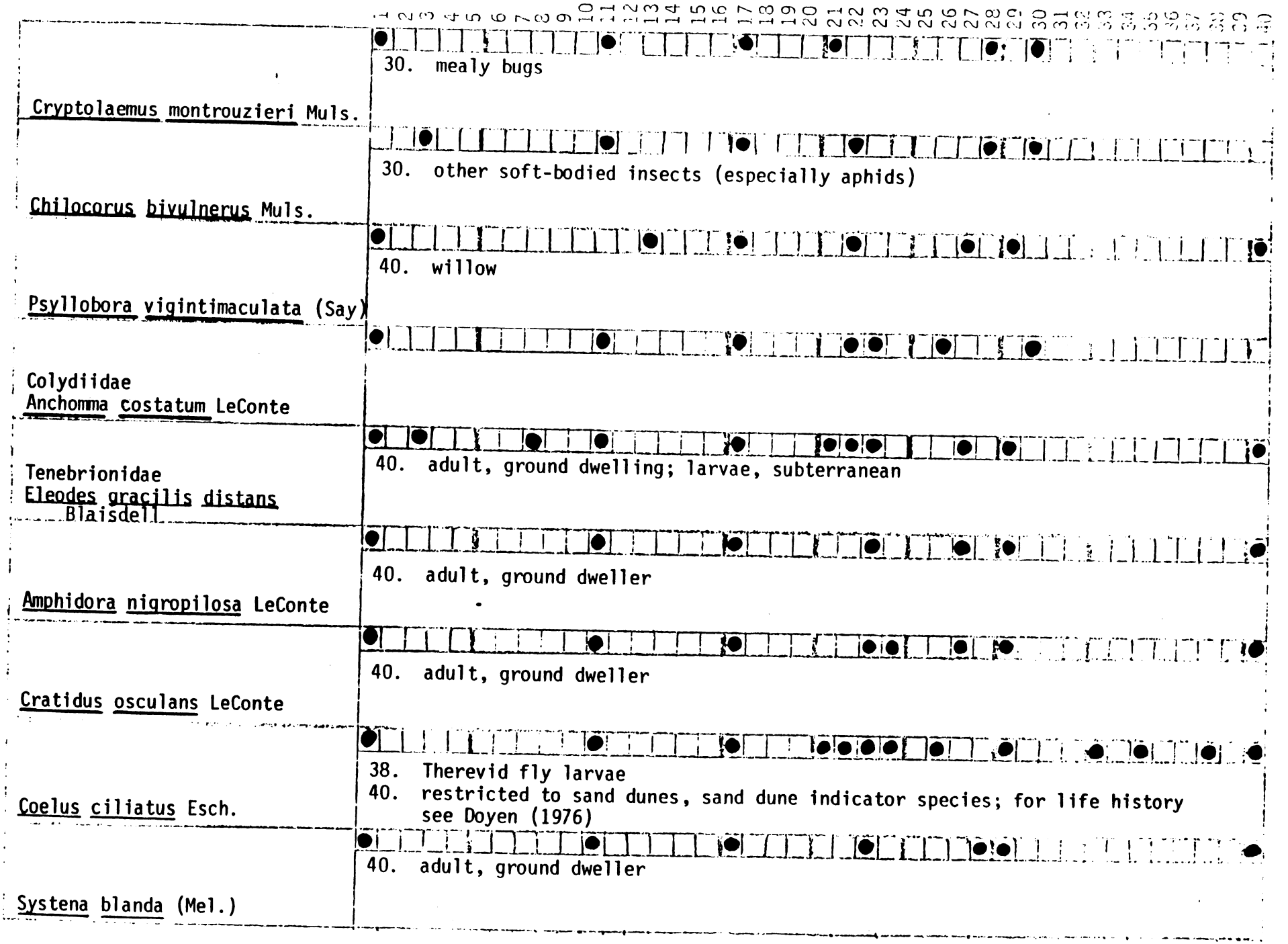

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Agonum crenistriatum LeConte?
40. ground dweller
Agonum maculicolle Dejean
40. ground dweller
Bembidion near quadrulum LeConte
30. adult, dead and dying insects
40. occurs near water; ground dweller
Tachys corax LeConte
40. ground dweller
Anisodactylus californicus Dejean
40. ground dweller
Bradycellus species
40. ground dweller
Stenolophus species
40. ground dweller
Apristus laticollis LeConte
40. ground dweller
Dytiscidae
Rhantus gutticollis (Say)
30. aquatic invertebrates and small vertebrates
40. aquatic freshwater


Hydrophilidae
Tropisternus species
29. adult, algae (Anabaenea; Clathrocystis)
30. larvae
40. fresh and brackish water
Enochrus species
29. adult, algae (Spirogyra, Mongeotia)
30. larvae
40. fresh and brackish water
Histeridae
Hypocacus lucidulus LeConte
11. collected at Venice Canal
30. fly larvae (Arnett 1960:372)
Saprinus lugens Eeichson
30. fly larvae (Arnett 1960:372)
Xerosaprinus lubricus LeConte
30. dead animal, record on dead Lampropeltis getulus
Xerosaprinus species
30. dead animal, record on dead Lampropeltis getulus
Miscellaneous unidentified species
Staphylinidae
Bledius strenus Casey
Paederus? species

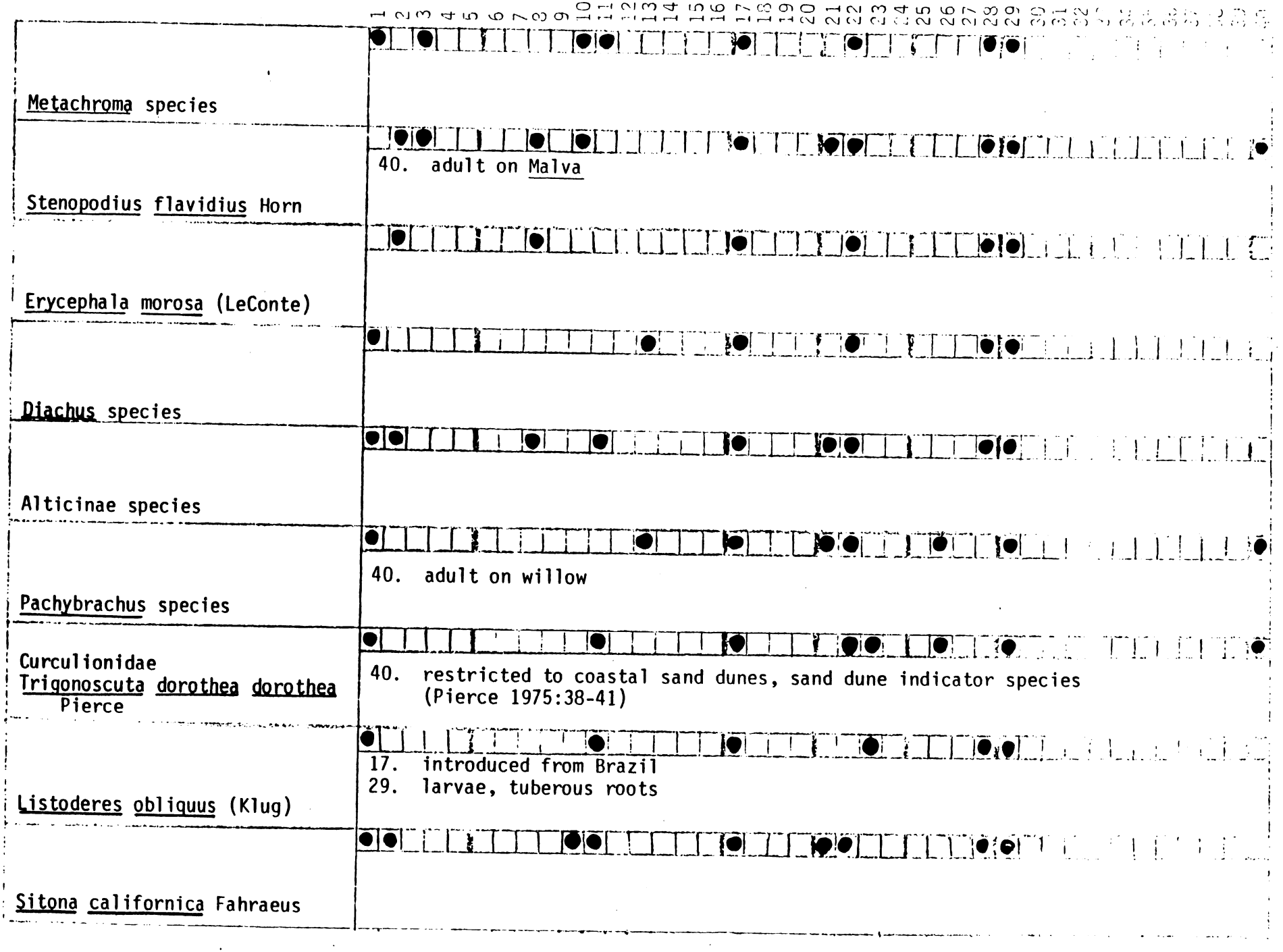

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Philonthus species 1
Philonthus species 2
Philonthus species 3
Bledius species
Ptinidae
Ptinidae species 1
Ptinidae species 2
Scarabaeidae
Aphodius fucosus (Schmidt)
29. adult, decaying vegetation. larvae?
40. under Lupinus (Venice Canal)
Aphodius lividius (Olivier)
29, 40. horse droppings?
Aphodius rugatus (Schmidt)

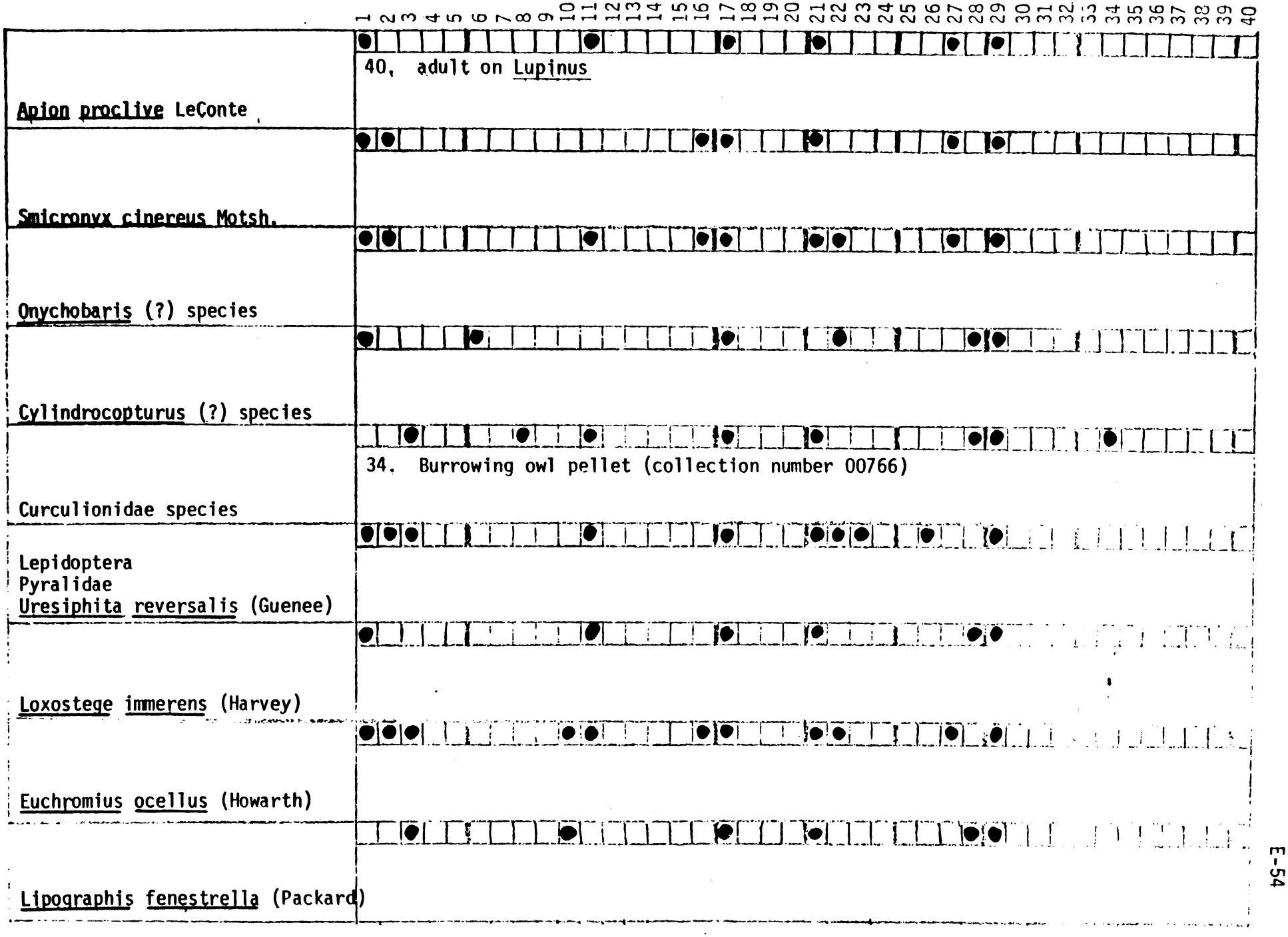

Parathyce palpalis Horn
40. adult, Lupinus
Bupreshidae
Acmaeodera labyrinthica Fall
29. larvae, stem borer; adult, flower feeder
Elateridae
Elater lecontei (Horn)
Anchastus cinerepennis (Esch.)
Melanotus longulus longulus (LeConte)
Melanotus species
Dermestidae
Dermestes species
30. Carrion, record on dead Lampropeltis getulus
Anthrenus lepidus conspersus (Casey)
29. adult, flowers of Carprobotus edulis
Anthrenus verbasci (Linne)
29. adult on Lupinus

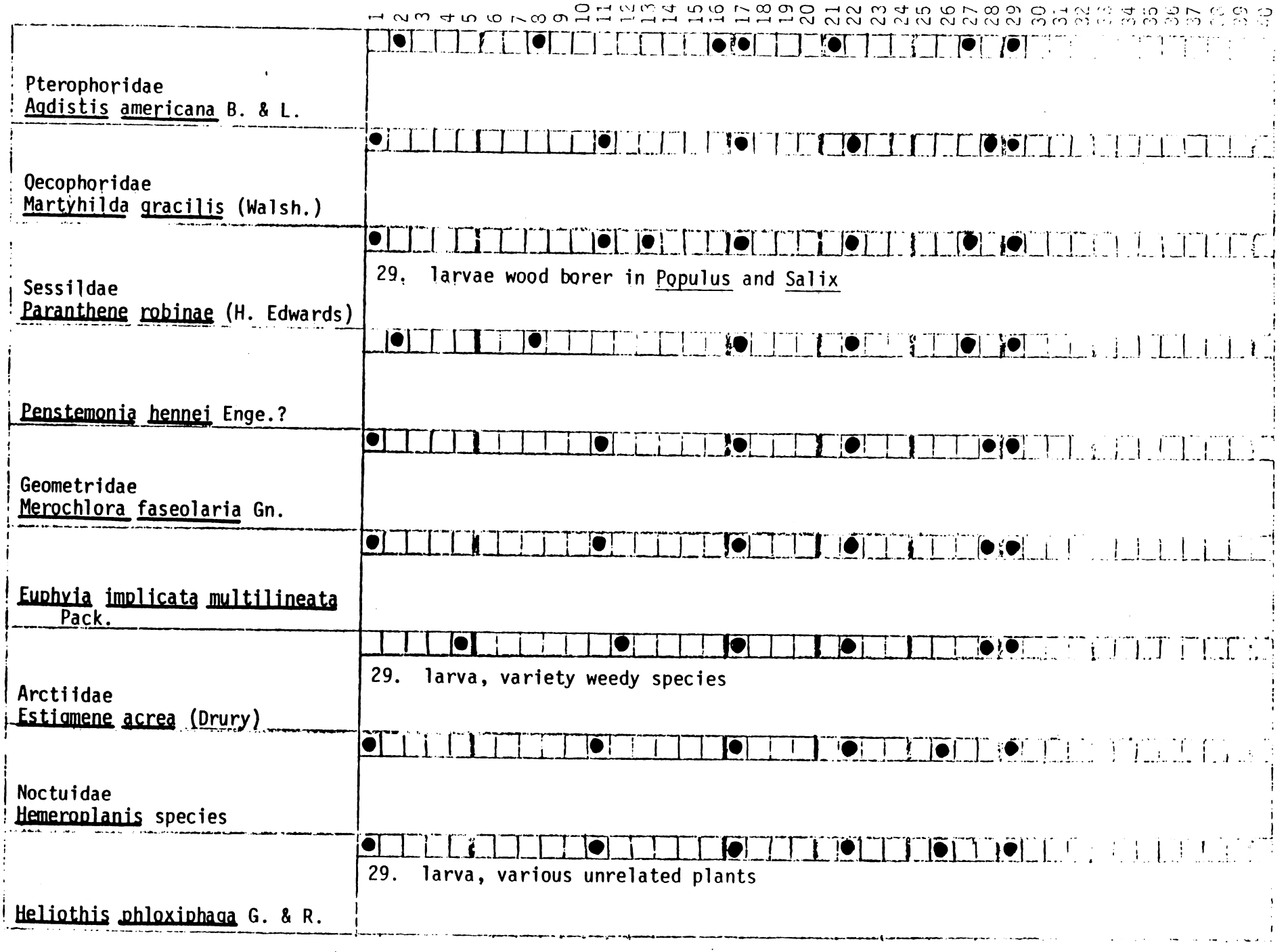

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Bostrichidae
Bostrichidae species
40. adult,, pickleweek litter
Cleridae
Phyllobaenus subfasciatus (LeConte)
Melyridae
Collops near marginellus LeConte
30. other insects
Trichochrus nigrinus Casey
40. adults, flowers of Chrysanthemum coronarium
Trichochrus suturalis (LeConte)
Coccinellidae
Coccinella californica Mann.
30. other soft-bodied insects (especially aphids)
Hippodamia convergens Guerin
30. other soft-bodied insects (especially aphids)
Exochomus fasciatus Casey
Olla abdominalis (Say)
30. other soft-bodied insects (especially aphids)

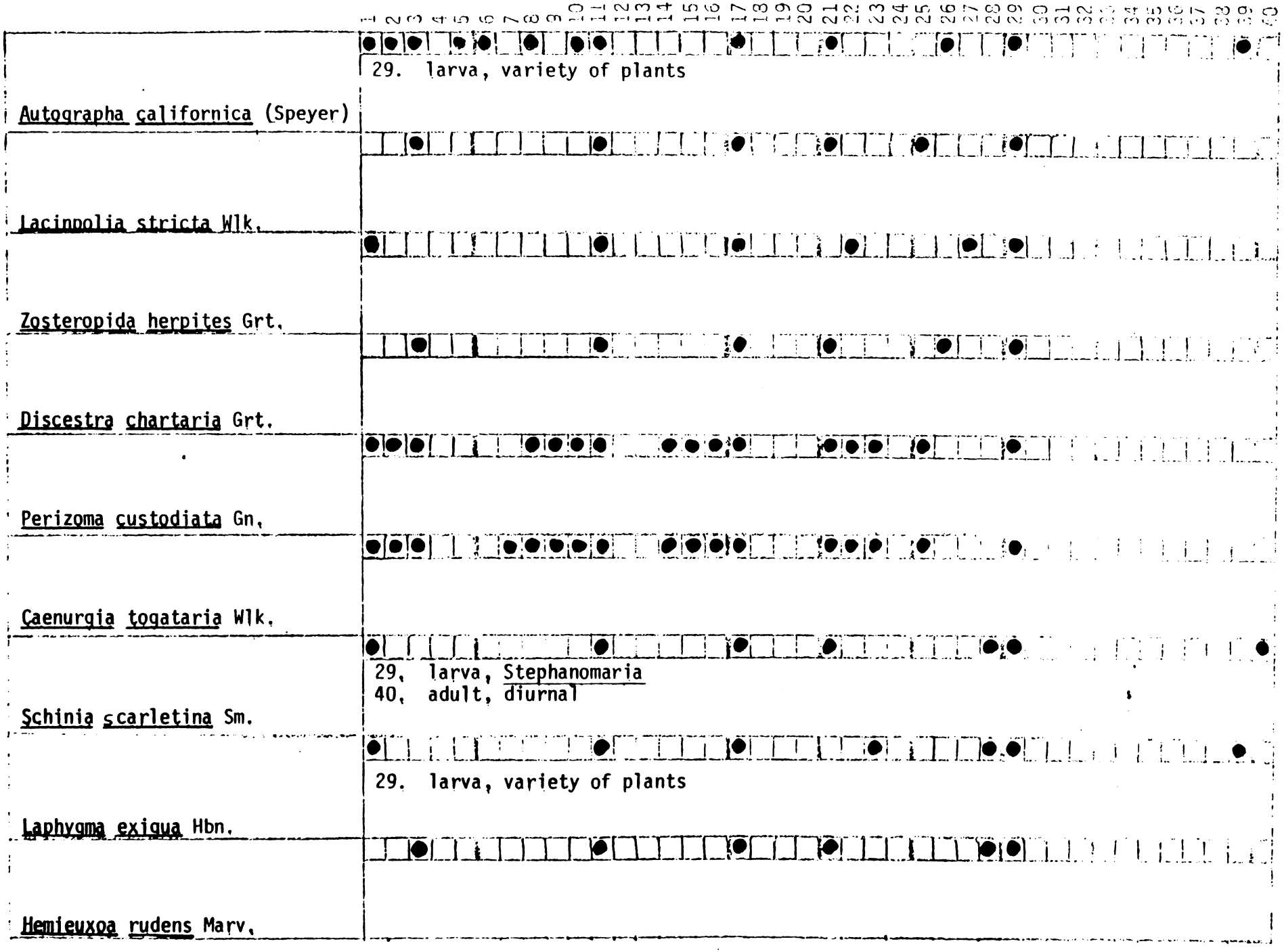

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
30. mealy bugs
Cryptolaemus montrouzieri Muls.
30. other soft-bodied insects (especially aphids)
Chilocorus bivulnerus Muls.
40. willow
Psyllobora vigintimaculata (Say)
Colydiidae
Anchomma costatum LeConte
40. adult, ground dwelling; larvae, subterranean
Tenebrionidae
Eleodes gracilis distans Blaisdell
40. adult, ground dweller
Amphidora nigropilosa LeConte
40. adult, ground dweller
Cratidus osculans LeConte
38. Therevid fly larvae
40. restricted to sand dunes, sand dune indicator species; for life history see Doyen (1976)
Coelus ciliatus Esch.
40. adult, ground dweller
Systena blanda (Mel.)

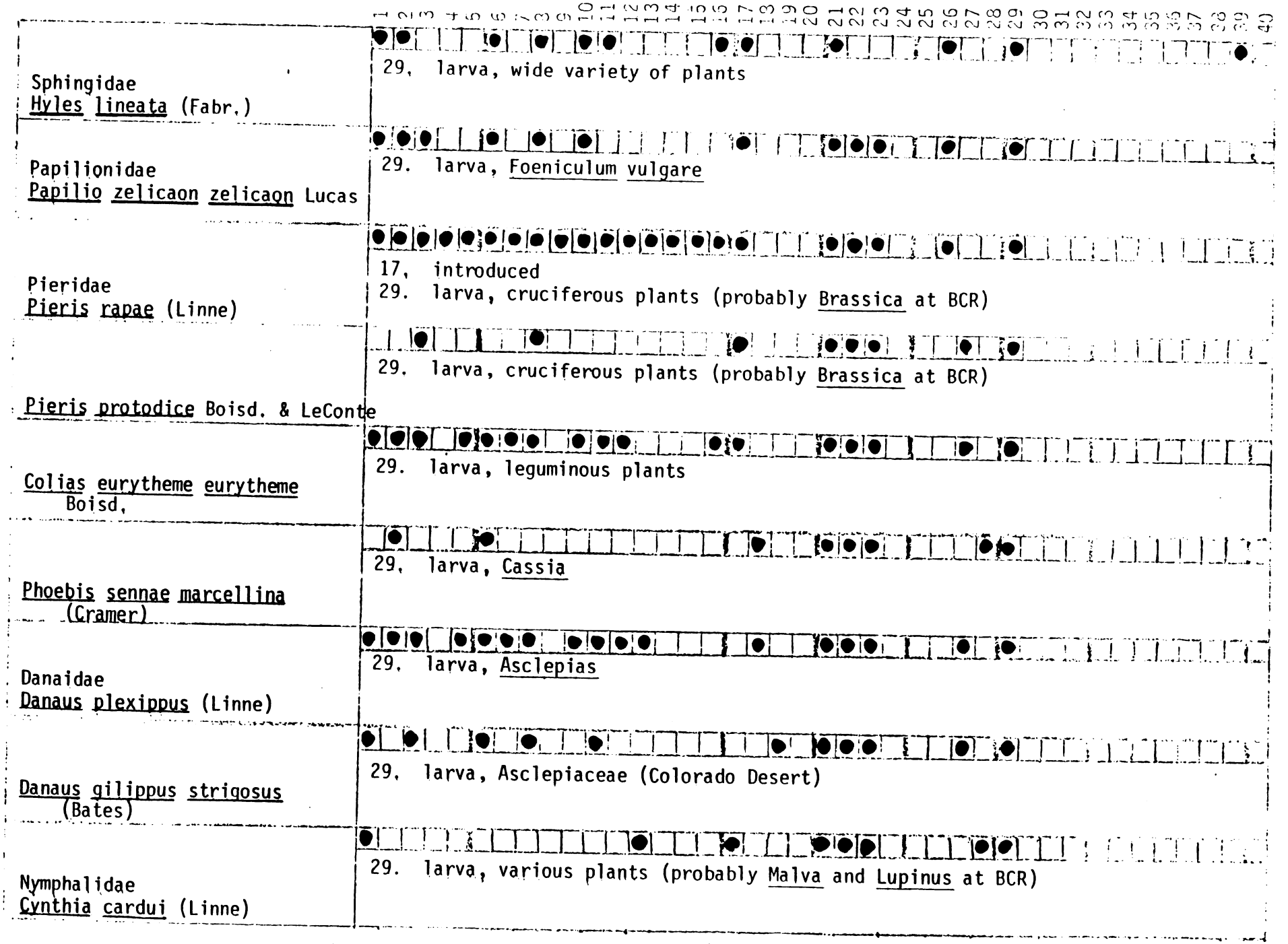
Coniontis species	40. adult, ground dweller
Epantius obscurus (LeConte)	40. adult, ground dweller
Oedemeridae Nacerdes melanura (Linne)	17. introduced 40. larvae in moist decaying wood, including driftwood
Mordellidae Mordella species	40. adult in flowers
Cerambyeidae Ipochus fasciatus LeConte	29. larvae woodborer
Chrysomelidae Diabrotica undecimpunctata undecimpunctata (Fabr.)	29. larvae root feeder
Altica carinata Germar	
Cryptocephalus castaneus LeConte	40. adult on willows
Metachroma californicum Crotch	

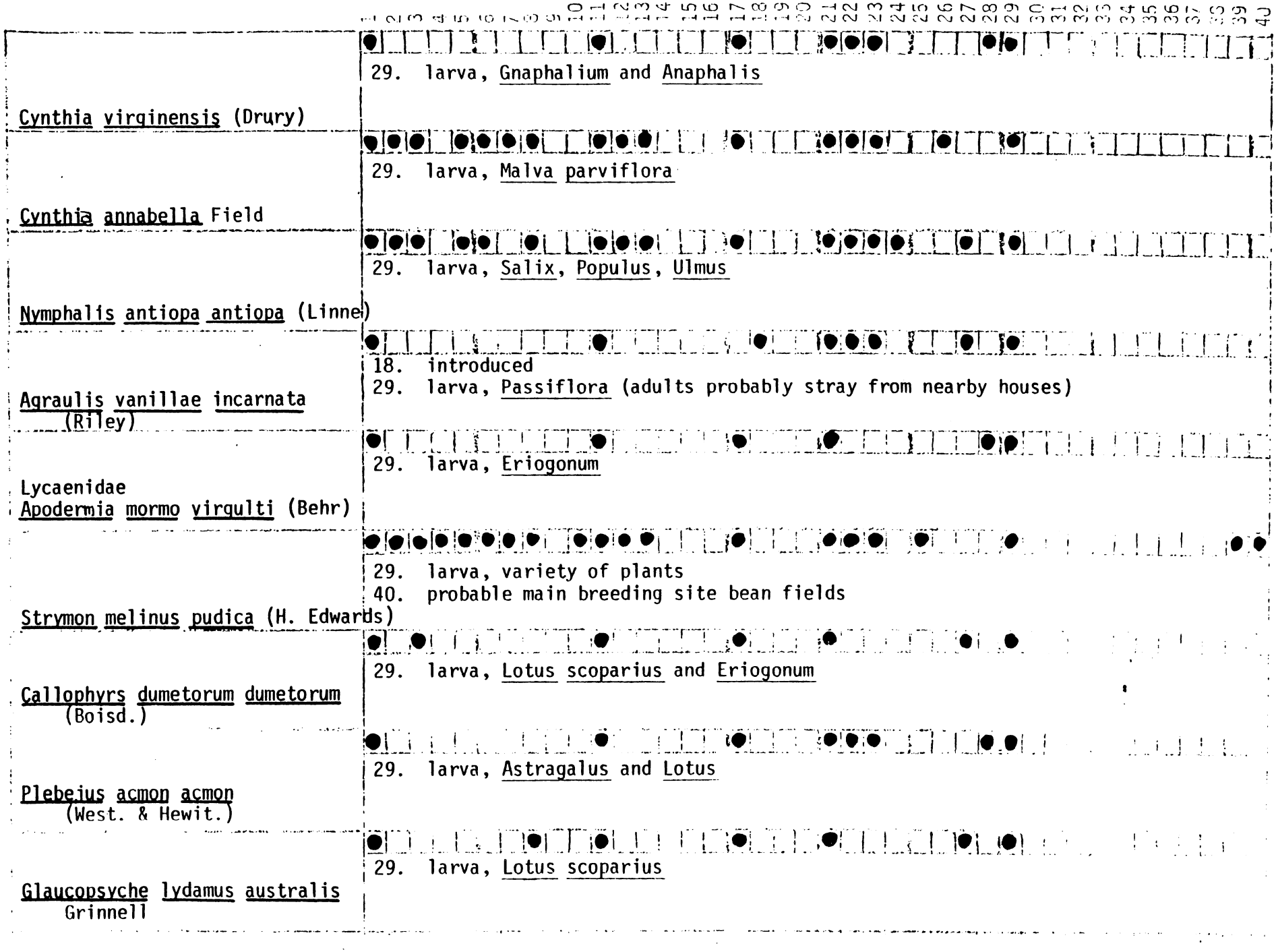

Metachroma species
Stenopodius flavidius Horn
40. adult on Malva
Erycephala morosa (LeConte)
Diachus species
Alticinae species
Pachybrachus species
40. adult on willow
Curculionidae
Trigonoscuta dorothea dorothea Pierce
40. restricted to coastal sand dunes, sand dune indicator species (Pierce 1975:38-41)
Listoderes obliquus (Klug)
17. introduced from Brazil
29. larvae, tuberous roots
Sitona californica Fahraeus


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
40. adult on Lupinus
Apion proclive LeConte
Smicronyx cinereus Motsh.
Onychobaris (?) species
Cylindrocopturus (?) species
34. Burrowing owl pellet (collection number 00766)
Curculionidae species
Lepidoptera
Pyralidae
Uresiphita reversalis (Guenee)
Loxostege immerens (Harvey)
Euchromius ocellus (Howarth)
Lipographis fenestrella (Packard)

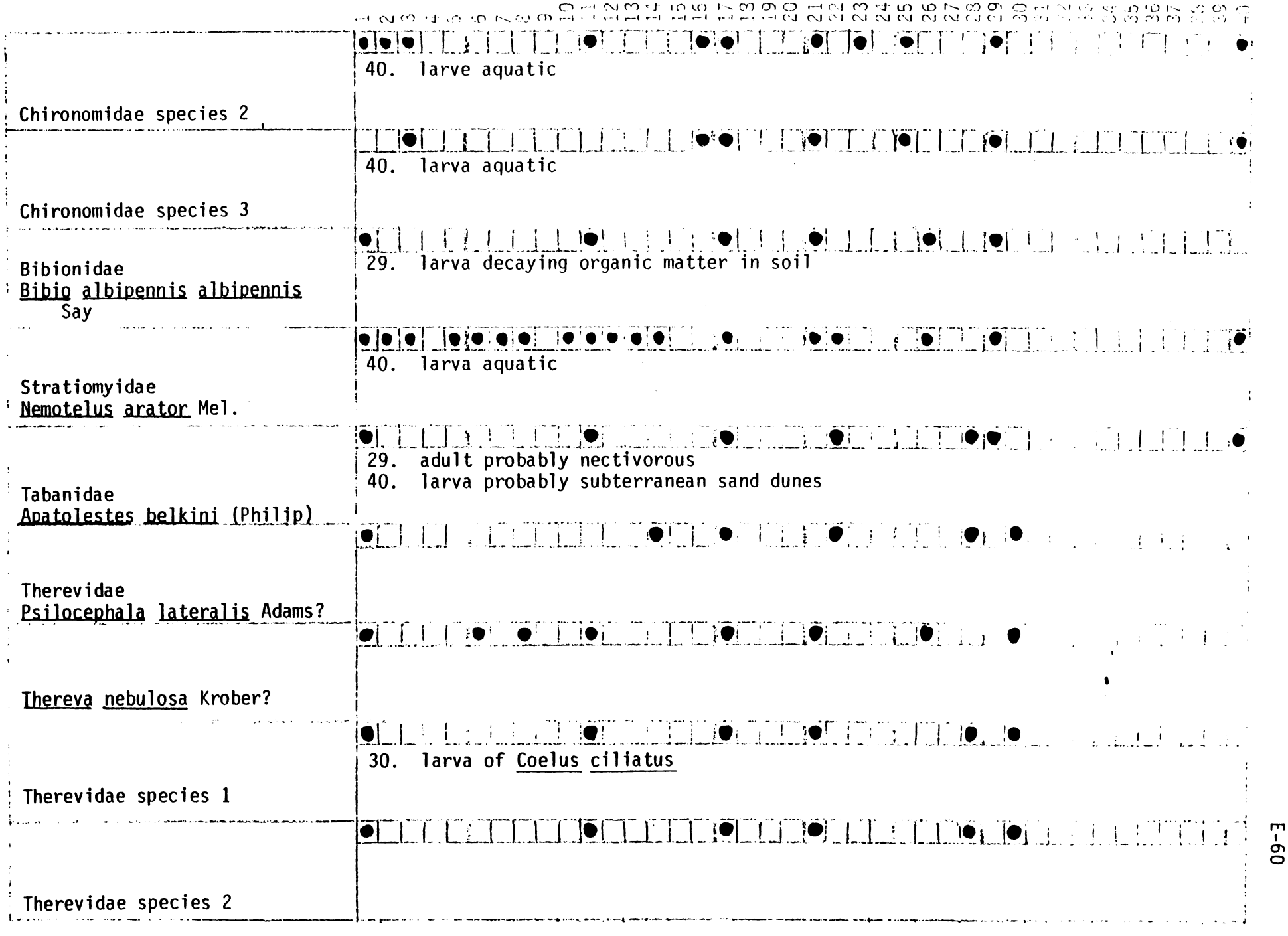

Pterophoridae
Agdistis americana B. & L.
Oecophoridae
Martyhilda gracilis (Walsh.)
Sessildae
Paranthene robinae (H. Edwards)
29. larvae wood borer in Populus and Salix
Penstemonia hennei Enge.?
Geometridae
Merochlora faseolaria Gn.
Euphyia implicata multilineata Pack.
Arctiidae
Estigmene acrea (Drury)
29. larva, variety weedy species
Noctuidae
Hemeroplanis species
Heliothis phloxiphaga G. & R.
29. larva, various unrelated plants

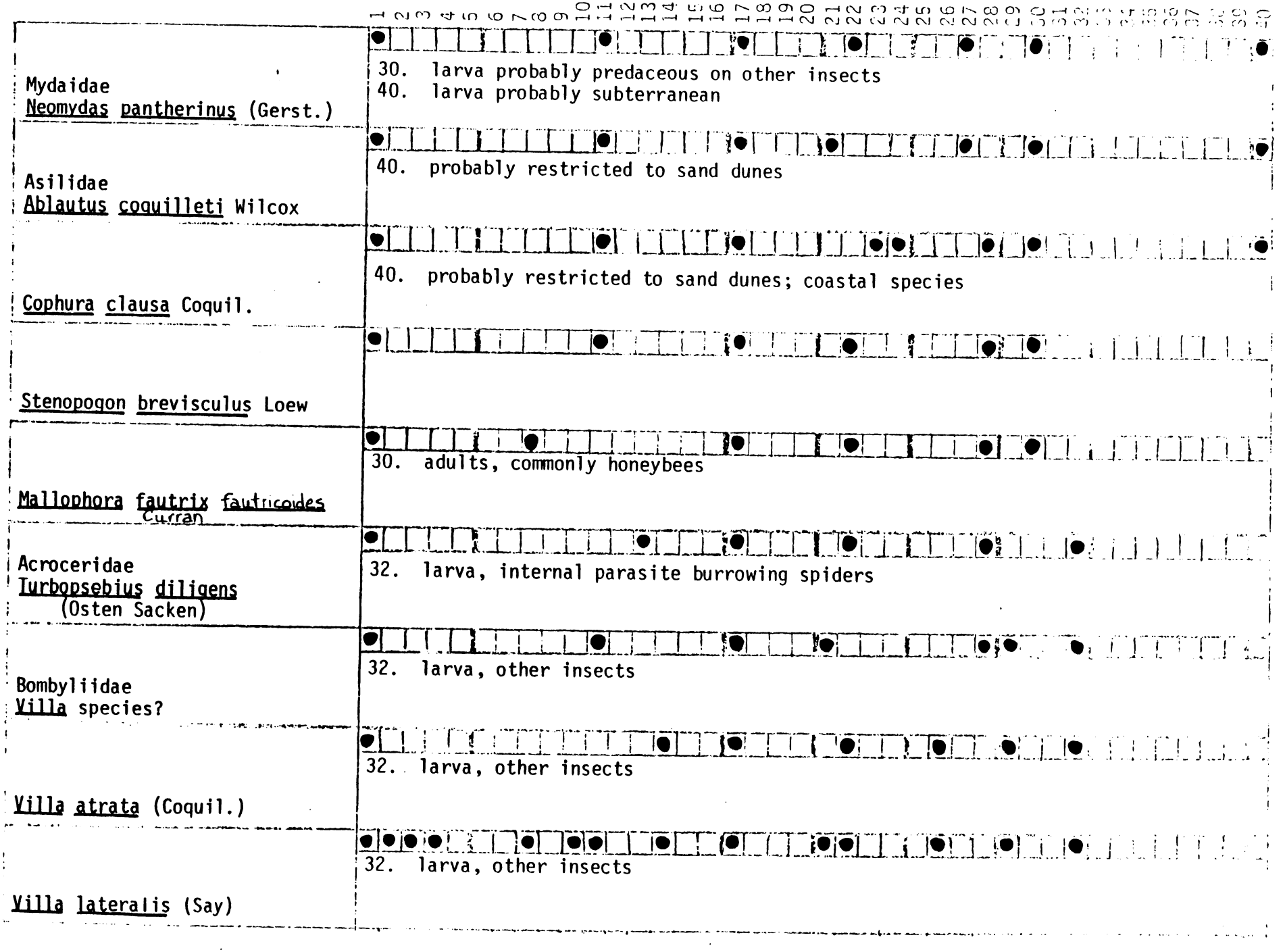

29. larva, variety of plants
Autographa californica (Speyer)
Lacinipolia stricta Wlk.
Zosteropida herpites Grt.
Discestra chartaria Grt.
Perizoma custodiata Gn.
Caenurgia togataria Wlk.
29, larva, Stephanomaria
40, adult, diurnal
Schinia scarletina Sm.
29. larva, variety of plants
Laphygma exigua Hbn.
Hemieuxoa rudens Marv.

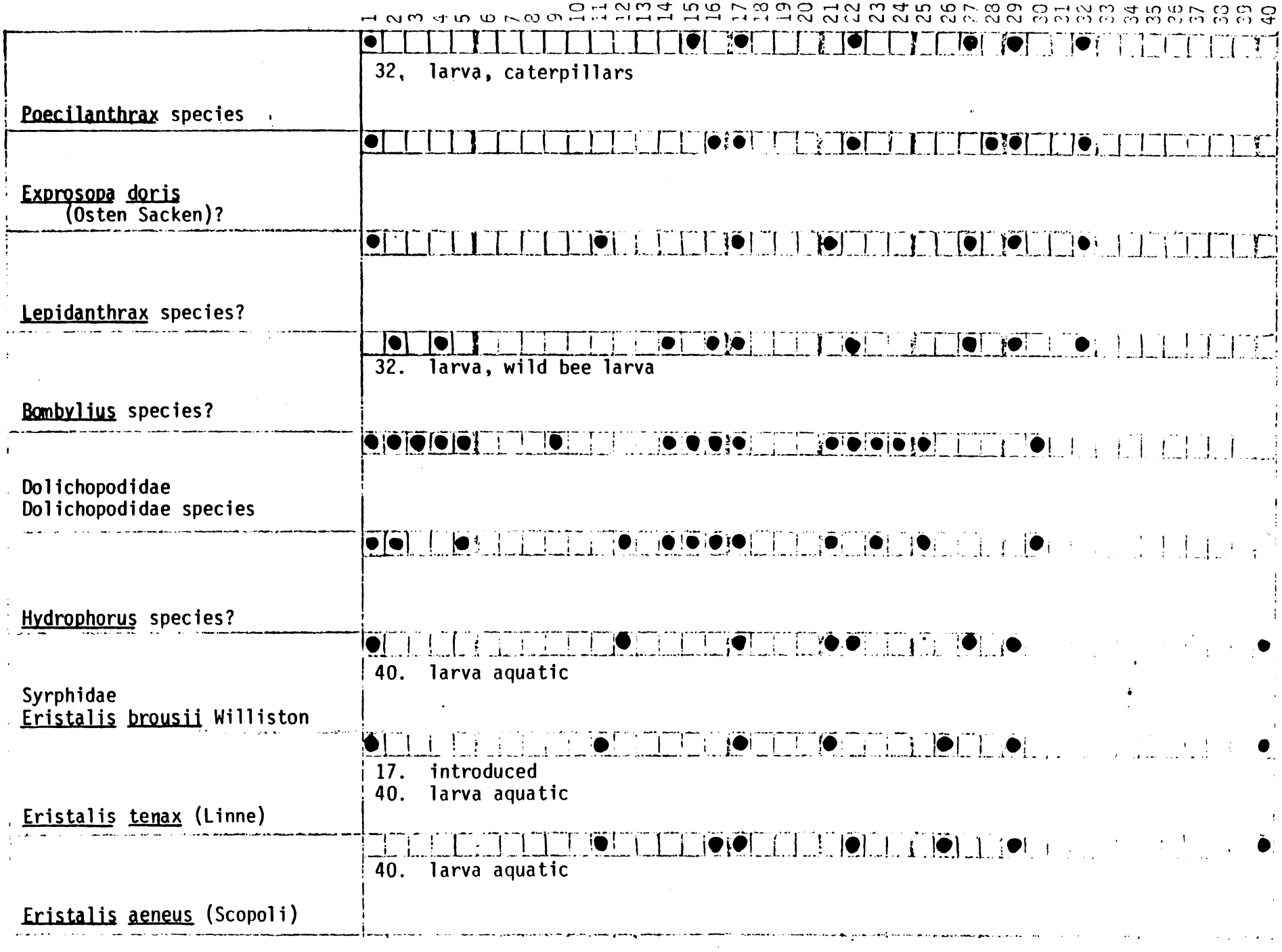

Sphingidae
Hyles lineata (Fabr.)
29. larva, wide variety of plants
Papilionidae
Papilio zelicaon zelicaon Lucas
29. larva, Foeniculum vulgare
Pieridae
Pieris rapae (Linne)
17. introduced
29. larva, cruciferous plants (probably Brassica at BCR)
Pieris protodice Boisd. & LeConte
29. larva, cruciferous plants (probably Brassica at BCR)
Colias eurytheme eurytheme Boisd.
29. larva, leguminous plants
Phoebis sennae marcellina (Cramer)
29. larva, Cassia
Danaidae
Danaus plexippus (Linne)
29. larva, Asclepias
Danaus gilippus strigosus (Bates)
29. larva, Asclepiaceae (Colorado Desert)
Nymphalidae
Cynthia cardui (Linne)
29. larva, various plants (probably Malva and Lupinus at BCR)

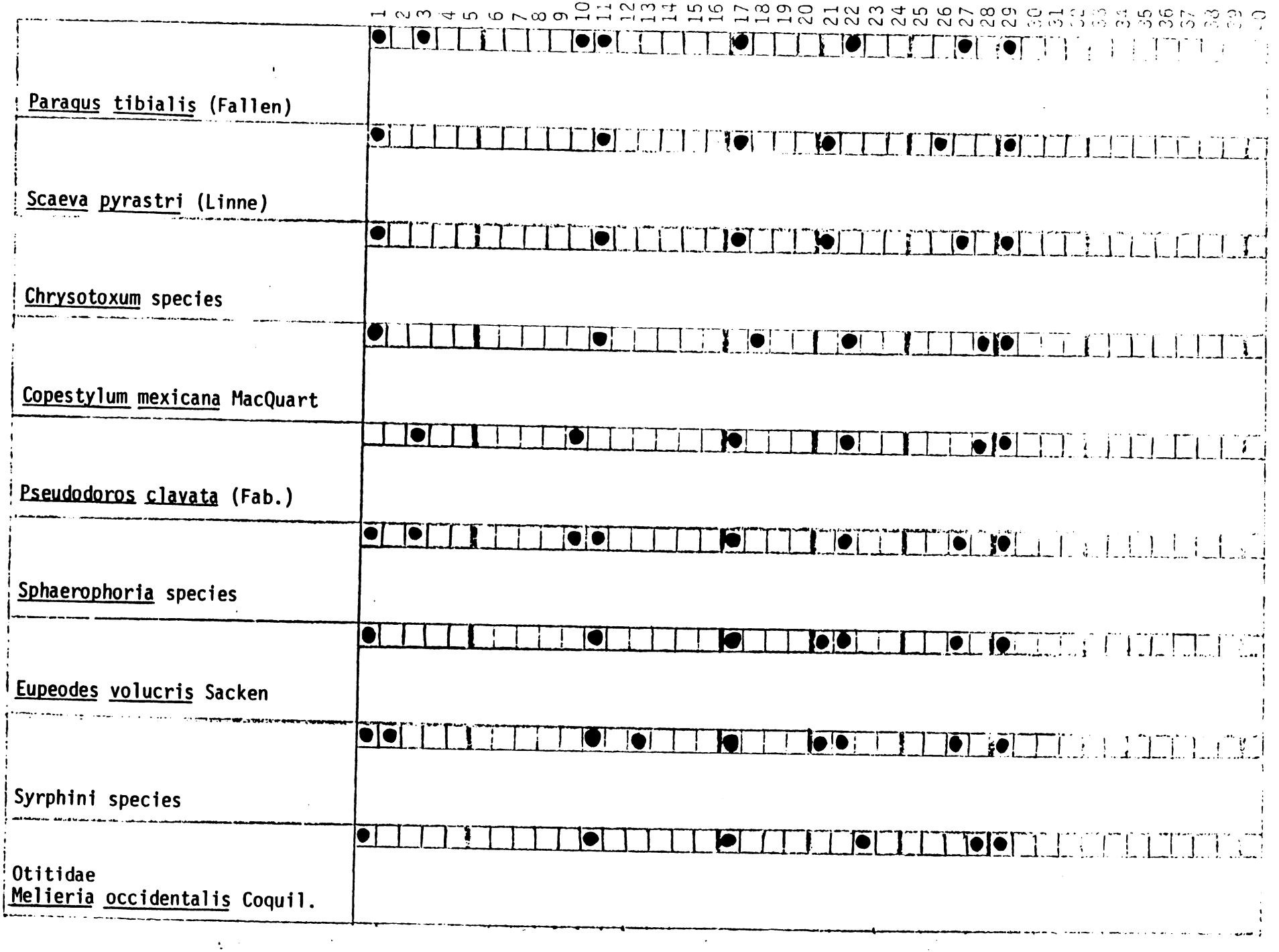

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
29. larva, Gnaphalium and Anaphalis
Cynthia virginensis (Drury)
29. larva, Malva parviflora
Cynthia annabella Field
29. larva, Salix, Populus, Ulmus
Nymphalis antiopa antiopa (Linne)
18. introduced
29. larva, Passiflora (adults probably stray from nearby houses)
Agraulis vanillae incarnata (Riley)
29. larva, Eriogonum
Lycaenidae
Apodermia mormo virgulti (Behr)
29. larva, variety of plants
40. probable main breeding site bean fields
Strymon melinus pudica (H. Edwards)
29. larva, Lotus scoparius and Eriogonum
Callophyrs dumetorum dumetorum (Boisd.)
29. larva, Astragalus and Lotus
Plebejus acmon acmon (West. & Hewit.)
29. larva, Lotus scoparius
Glaucopsyche lydamus australis Grinnell

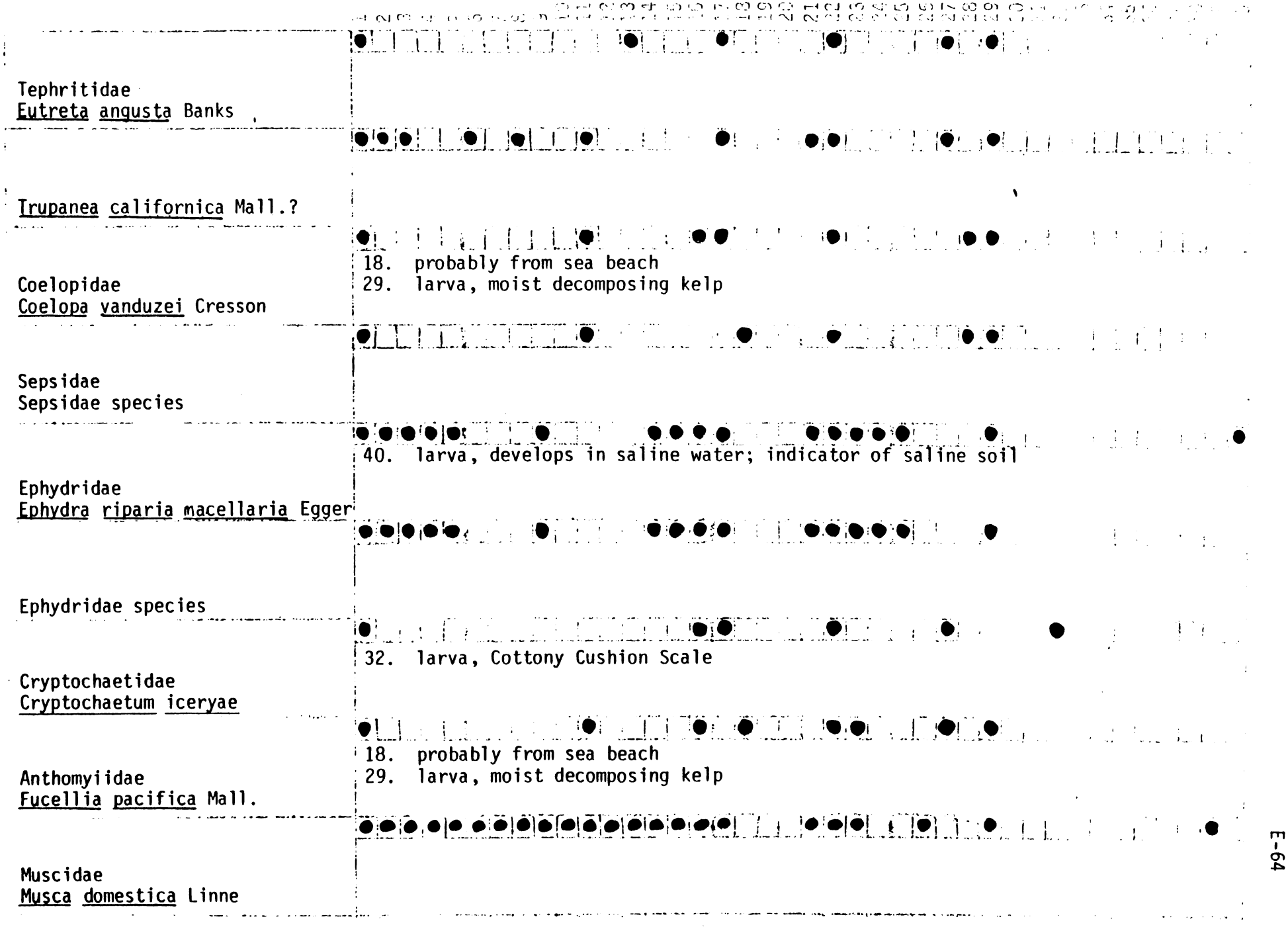
Leptotes marina (Reakirt)	29. larva, Plumbago, Medicago, and Astragulus
Brephidium exilis exilis (Boisd.)	29. larva, Chenopodium and Atriplex 40. probable indicator species of saline soils
Hesperidae Paroquina errans (Skinner)	29. larva, Distichlis spicata 40. salt marsh indicator species
Hylephila phyleus (Drury)	29. larva, Bermuda Grass
Erynnis funeralis (Scudd. & Burgess)	29. larva, Lotus
Diptera Tipulidae Dicranoptycha occidentalis Alexander	
Culicidae Aedes squamiger Coq.	30. females bite humans 40. larva, brackish water; salt marsh indicator species
Culiseta inornata (Williston)	30. females occasionally bite humans 40. larva, ground pools, brackish water; associated with A. squamiger
Chironomidae Chironomidae species 1	40. larva aquatic

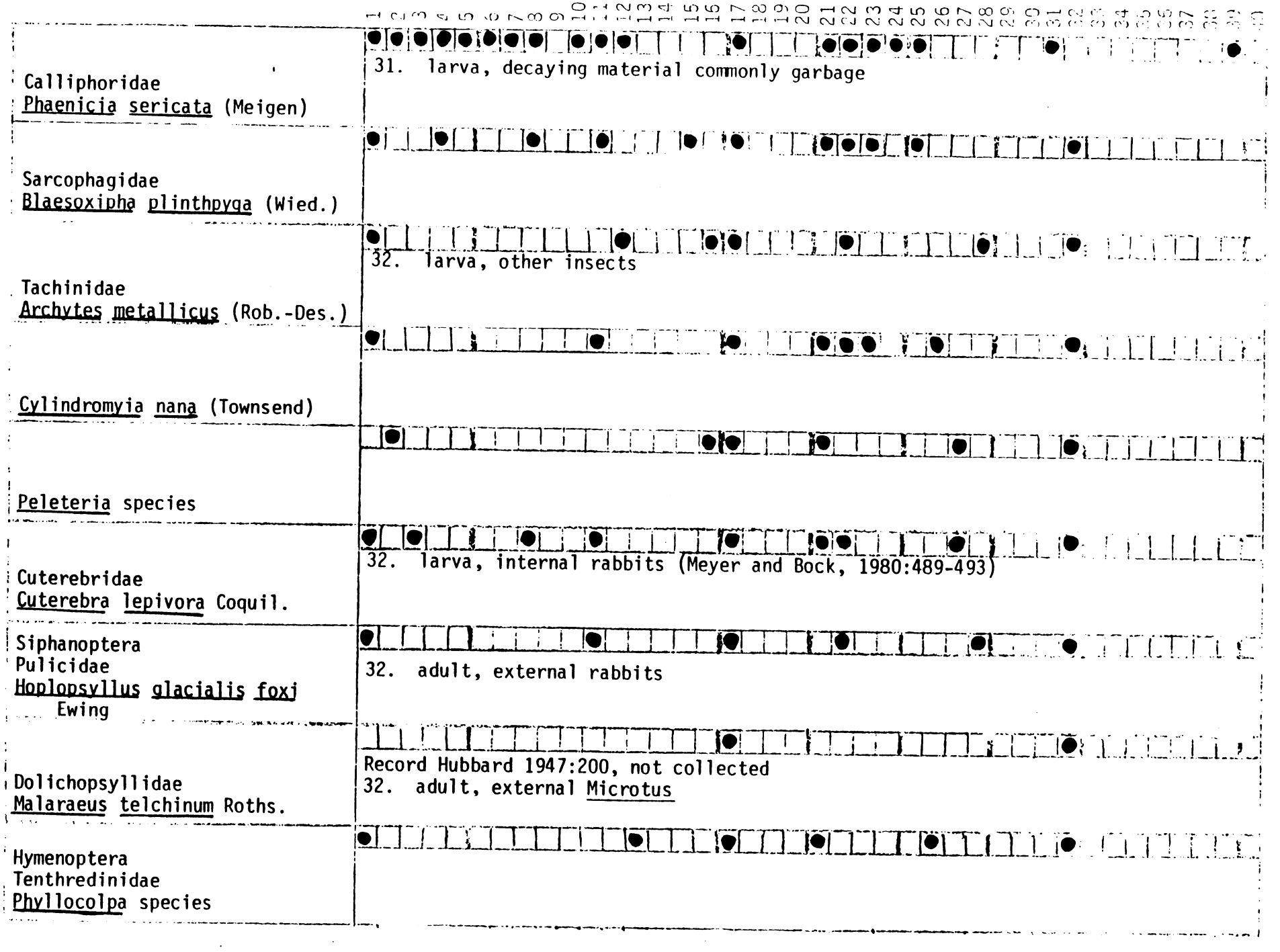

Chironomidae species 2
40. larve aquatic
Chironomidae species 3
40. larva aquatic
Bibionidae
Bibio albipennis albipennis Say
29. larva decaying organic matter in soil
Stratiomyidae
Nemotelus arator Mel.
40. larva aquatic
Tabanidae
Apatolestes belkini (Philip)
29. adult probably nectivorous
40. larva probably subterranean sand dunes
Therevidae
Psilocephala lateralis Adams?
Thereva nebulosa Krober?
Therevidae species 1
30. larva of Coelus ciliatus
Therevidae species 2

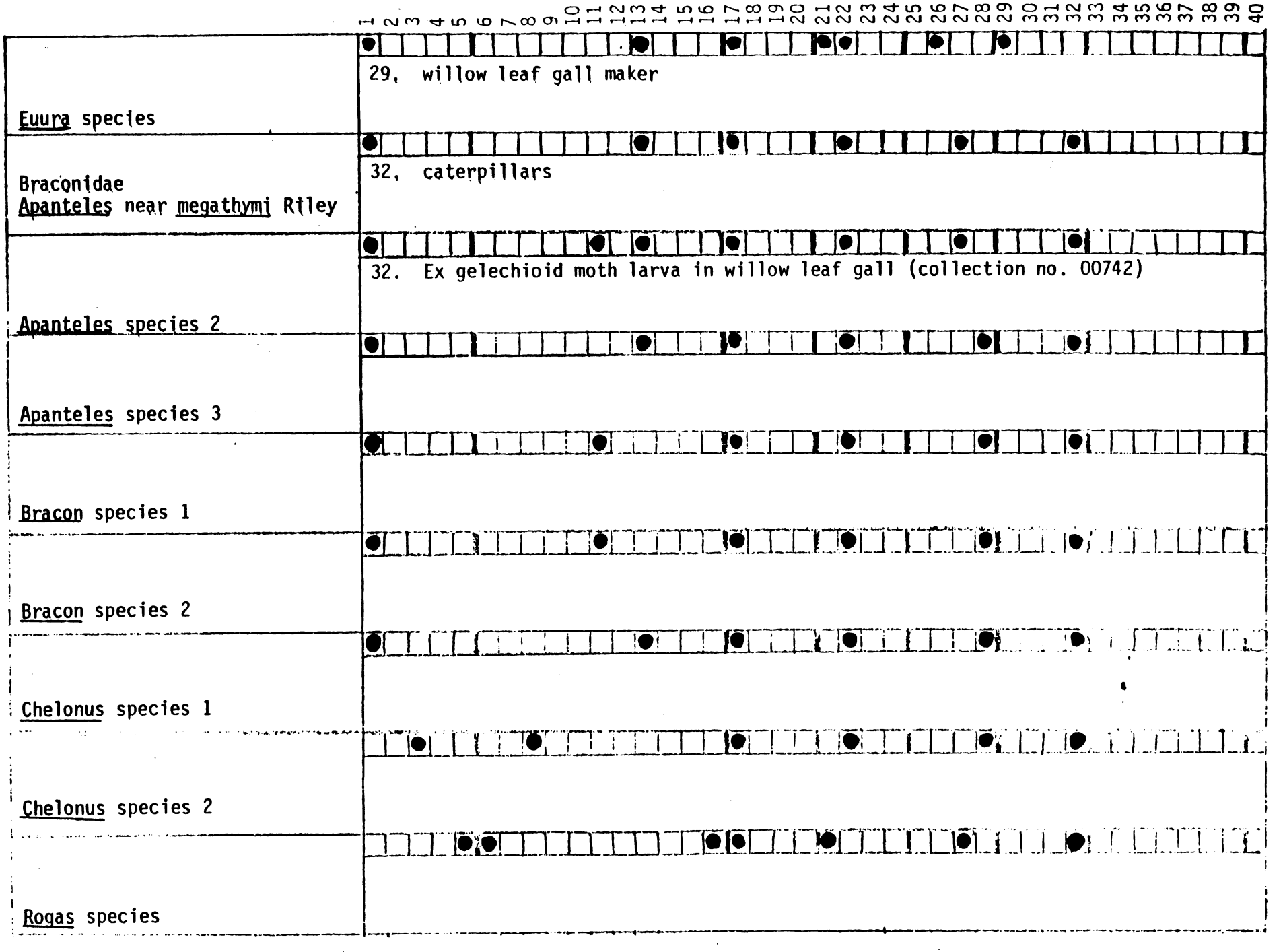

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Mydaidae
Neomydas pantherinus (Gerst.)
30. larva probably predaceous on other insects
40. larva probably subterranean
Asilidae
Ablautus coquilleti Wilcox
40. probably restricted to sand dunes
Cophura clausa Coquil.
40. probably restricted to sand dunes; coastal species
Stenopogon brevisculus Loew
Mallophora fautrix fautricoides Curran
30. adults, commonly honeybees
Acroceridae
Turbopsebius diligens (Osten Sacken)
32. larva, internal parasite burrowing spiders
Bombyliidae
Villa species?
32. larva, other insects
Villa atrata (Coquil.)
32. larva, other insects
Villa lateralis (Say)

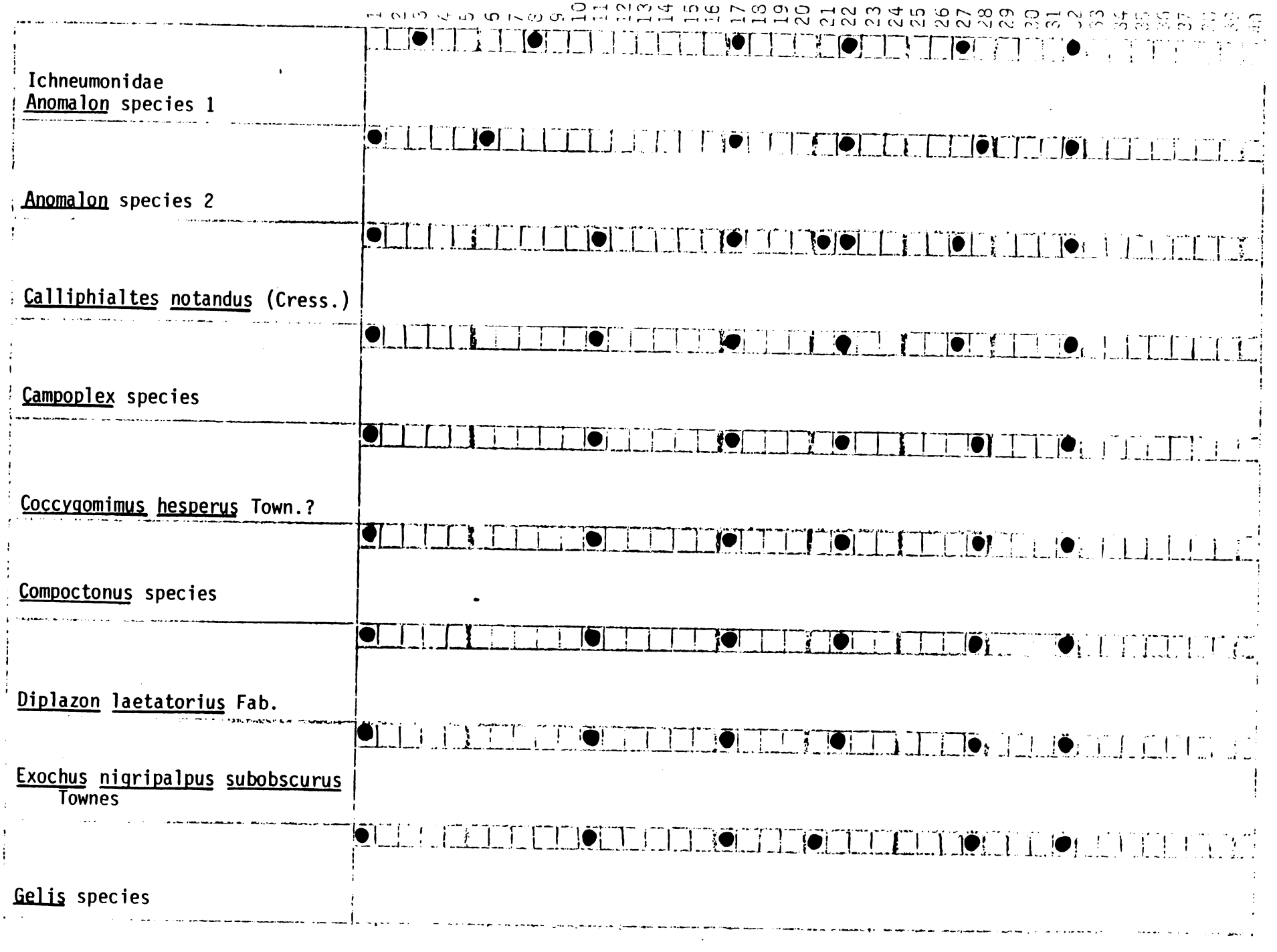

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
32. larva, caterpillars
Poecilanthrax species
Exprosopa doris (Osten Sacken)?
Lepidanthrax species?
32. larva, wild bee larva
Bombylius species?
Dolichopodidae
Dolichopodidae species
Hydrophorus species?
40. larva aquatic
Syrphidae
Eristalis brousii Williston
17. introduced
40. larva aquatic
Eristalis tenax (Linne)
40. larva aquatic
Eristalis aeneus (Scopoli)

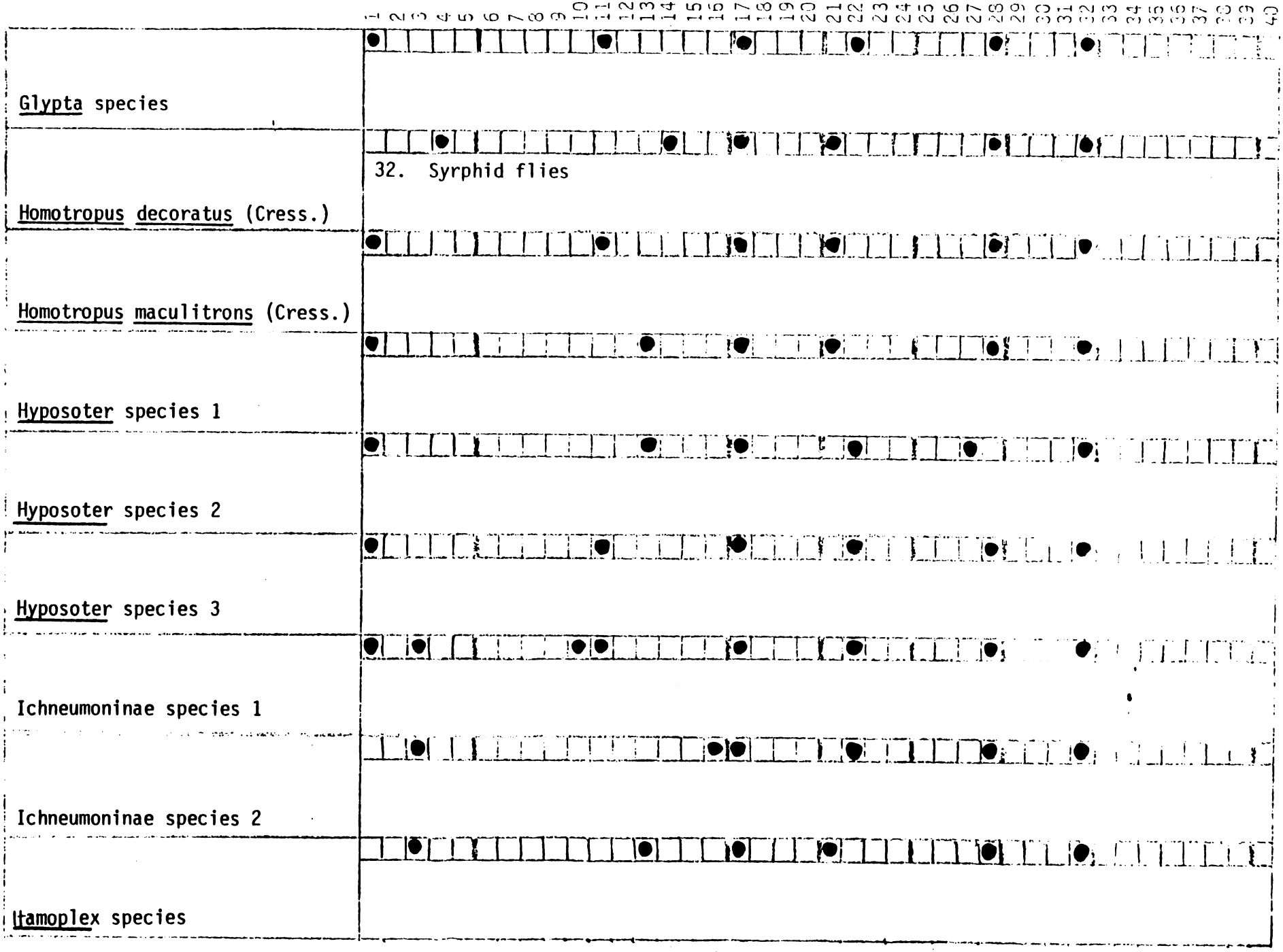

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Paragus tibialis (Fallen)
Scaeva pyrastri (Linne)
Chrysotoxum species
Copestylum mexicana MacQuart
Pseudodoros clavata (Fab.)
Sphaerophoria species
Eupeodes volucris Sacken
Syrphini species
Otitidae
Melieria occidentalis Coquil.

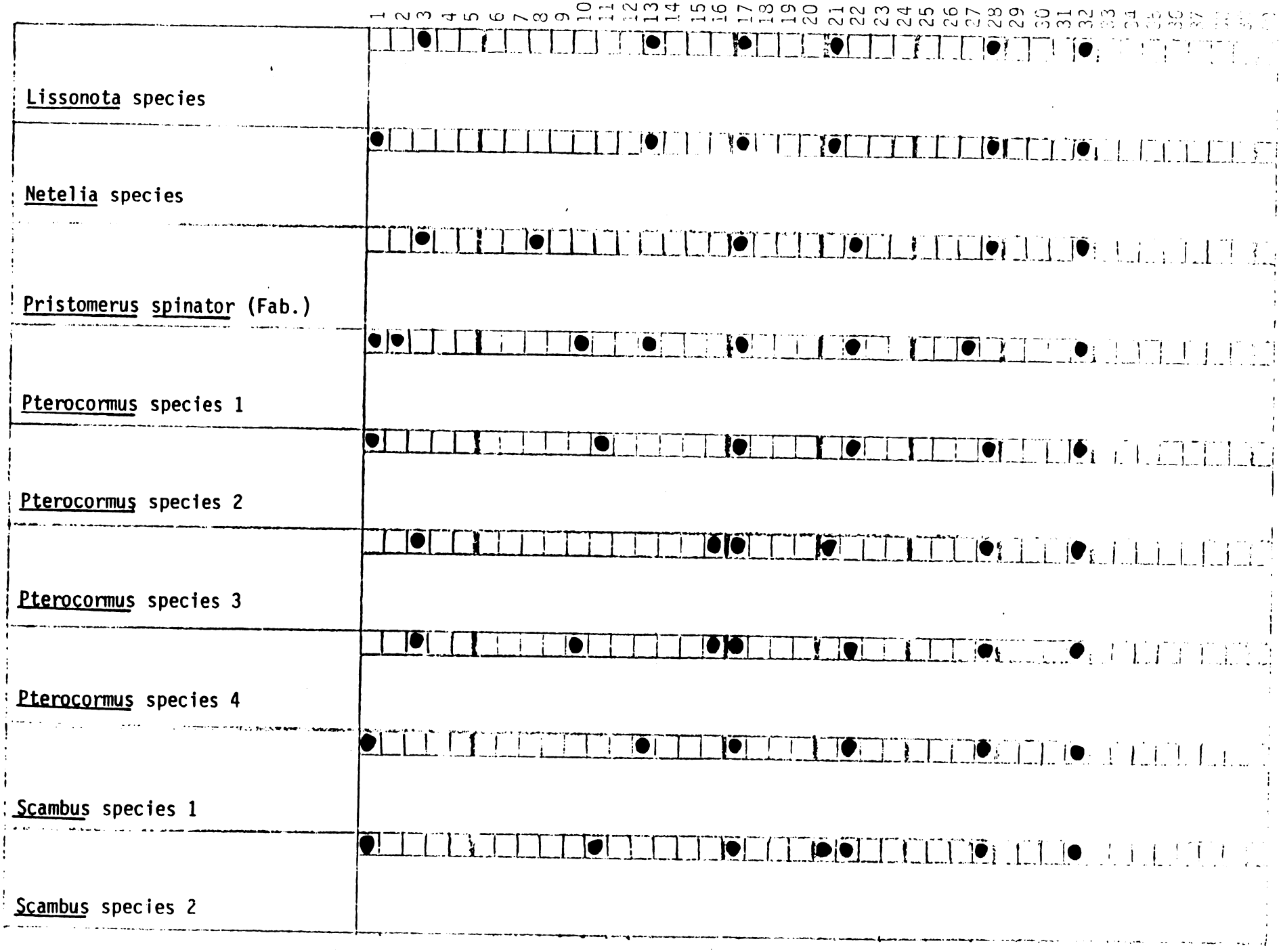

Tephritidae
Eutreta angusta Banks
Trupanea californica Mall.?
18. probably from sea beach
29. larva, moist decomposing kelp
Coelopidae
Coelopa vanduzei Cresson
Sepsidae
Sepsidae species
40. larva, develops in saline water; indicator of saline soil
Ephydridae
Ephydra riparia macellaria Egger
Ephydridae species
32. larva, Cottony Cushion Scale
Cryptochaetidae
Cryptochaetum iceryae
18. probably from sea beach
29. larva, moist decomposing kelp
Anthomyiidae
Fucellia pacifica Mall.
Muscidae
Musca domestica Linne

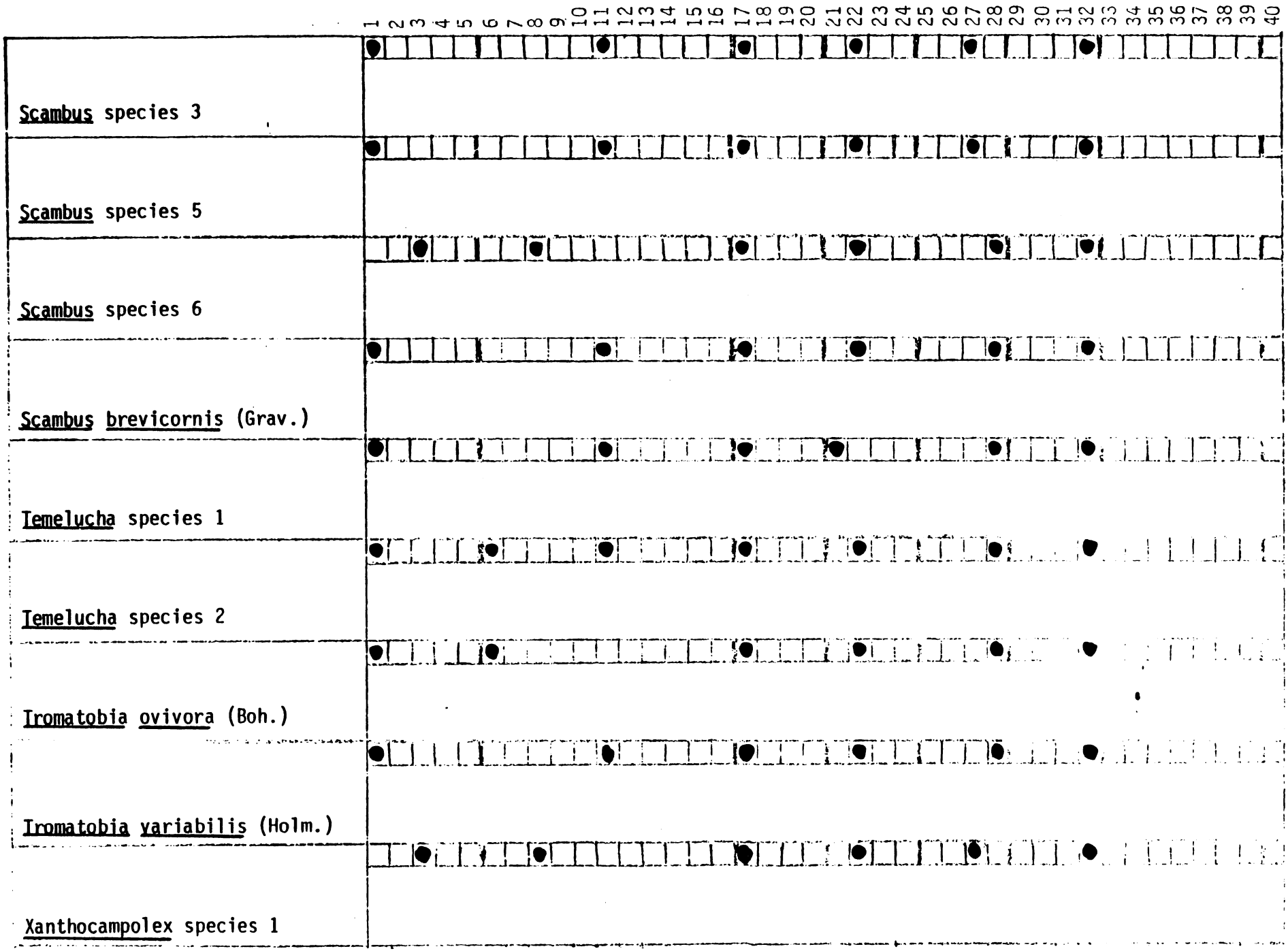

Calliphoridae
Phaenicia sericata (Meigen)
31. larva, decaying material commonly garbage
Sarcophagidae
Blaesoxipha plinthpyga (Wied.)
Tachinidae
Archytes metallicus (Rob.-Des.)
32. larva, other insects
Cylindromyia nana (Townsend)
Peleteria species
Cuterebridae
Cuterebra lepivora Coquil.
32. larva, internal rabbits (Meyer and Bock, 1980:489-493)
Siphanoptera
Pulicidae
Hoplopsyllus glacialis foxi Ewing
32. adult, external rabbits
Dolichopsyllidae
Malaraeus telchinum Roths.
Record Hubbard 1947:200, not collected
32. adult, external Microtus
Hymenoptera
Tenthredinidae
Phyllocolpa species

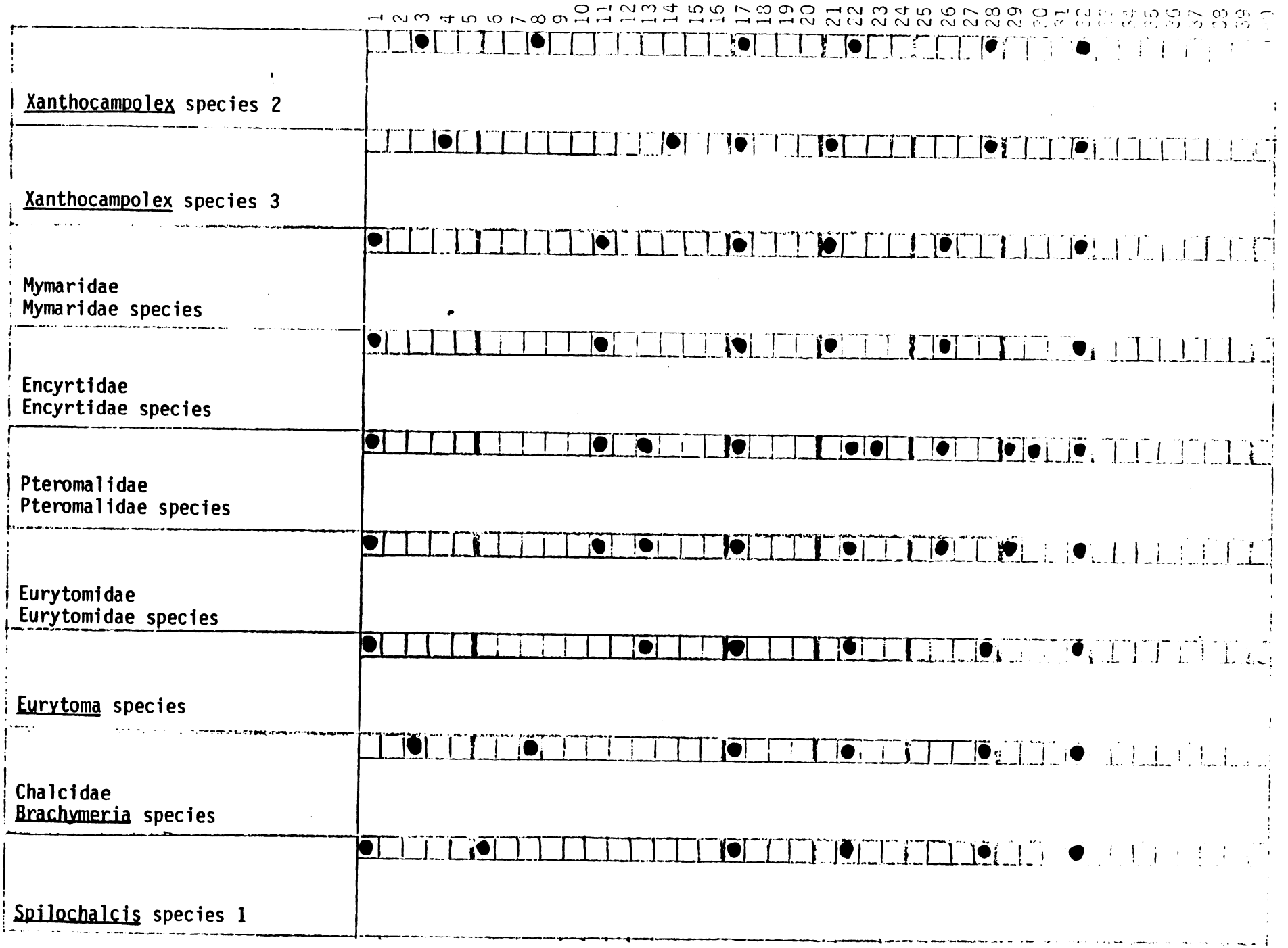

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Euura species
29. willow leaf gall maker
Braconidae
Apanteles near megathymi Riley
32. caterpillars
32. Ex gelechioid moth larva in willow leaf gall (collection no. 00742)
Apanteles species 2
Apanteles species 3
Bracon species 1
Bracon species 2
Chelonus species 1
Chelonus species 2
Rogas species

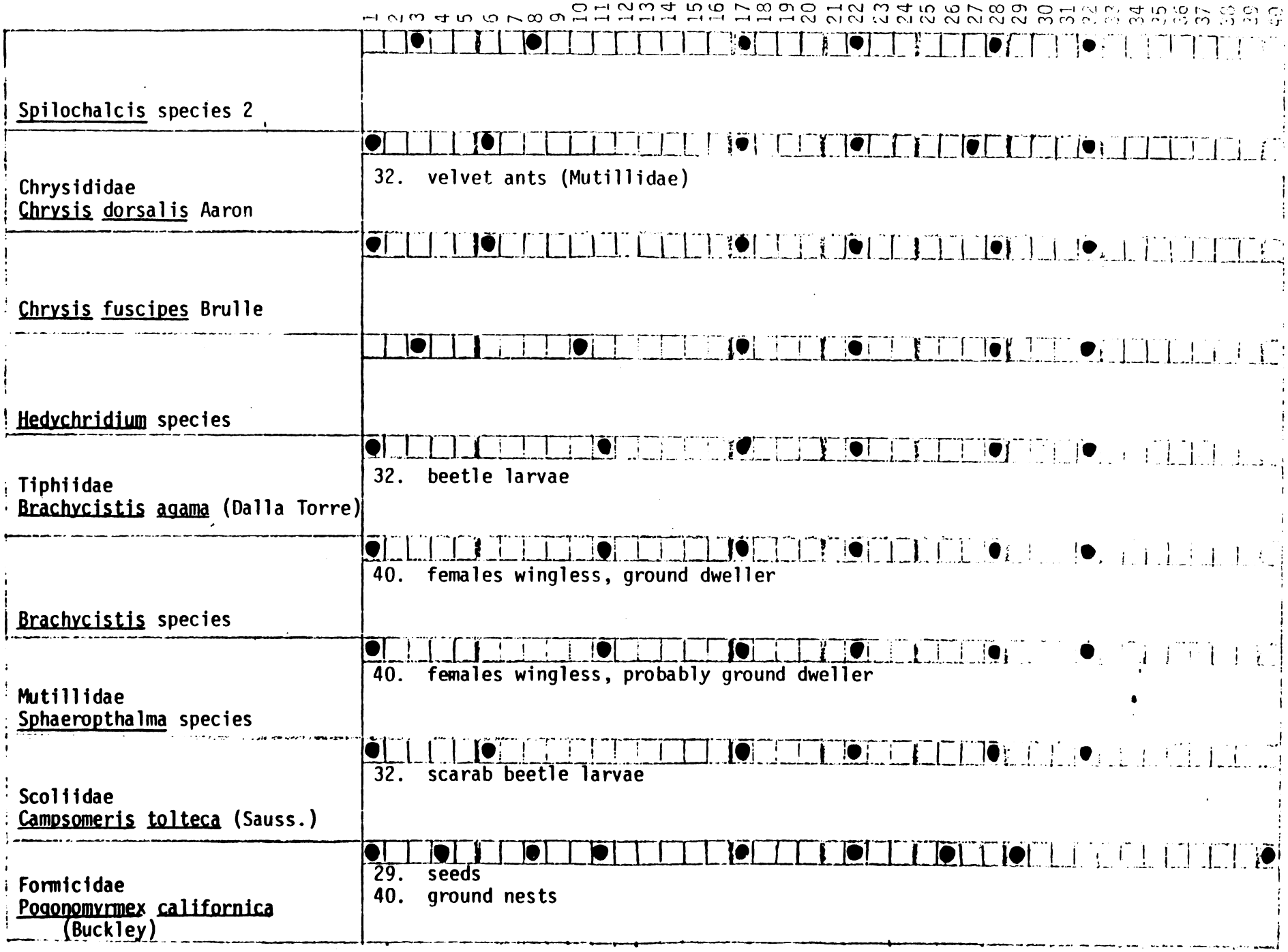

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Ichneumonidae
Anomalon species 1
Anomalon species 2
Calliphialtes notandus (Cress.)
Campoplex species
Coccygomimus hesperus Town.?
Compoctonus species
Diplazon laetatorius Fab.
Exochus nigripalpus subobscurus Townes
Gelis species

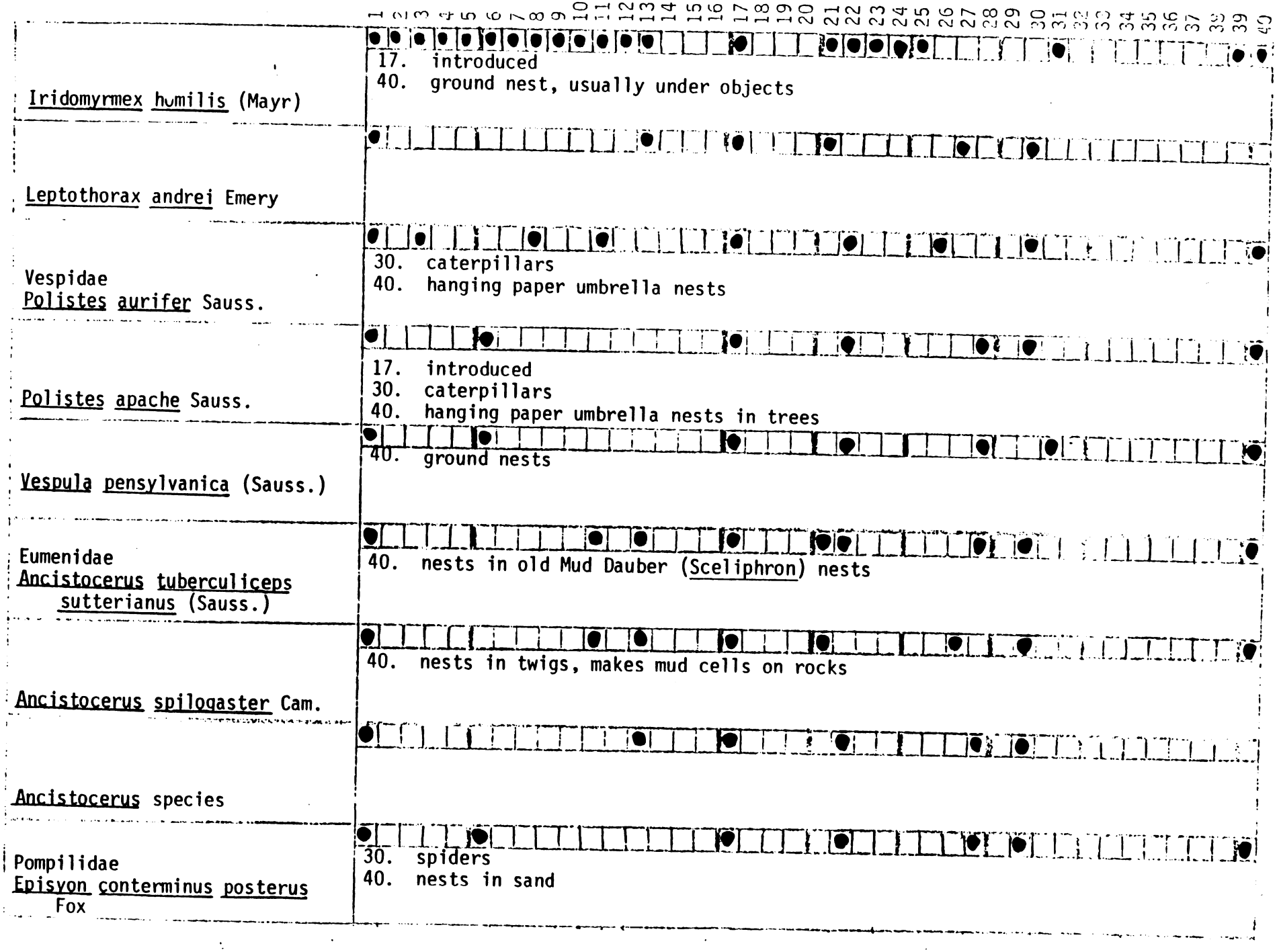

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Glypta species
32. Syrphid flies
Homotropus decoratus (Cress.)
Homotropus maculitrons (Cress.)
Hyposoter species 1
Hyposoter species 2
Hyposoter species 3
Ichneumoninae species 1
Ichneumoninae species 2
Itamoplex species


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Lissonota species
Netelia species
Pristomerus spinator (Fab.)
Pterocormus species 1
Pterocormus species 2
Pterocormus species 3
Pterocormus species 4
Scambus species 1
Scambus species 2

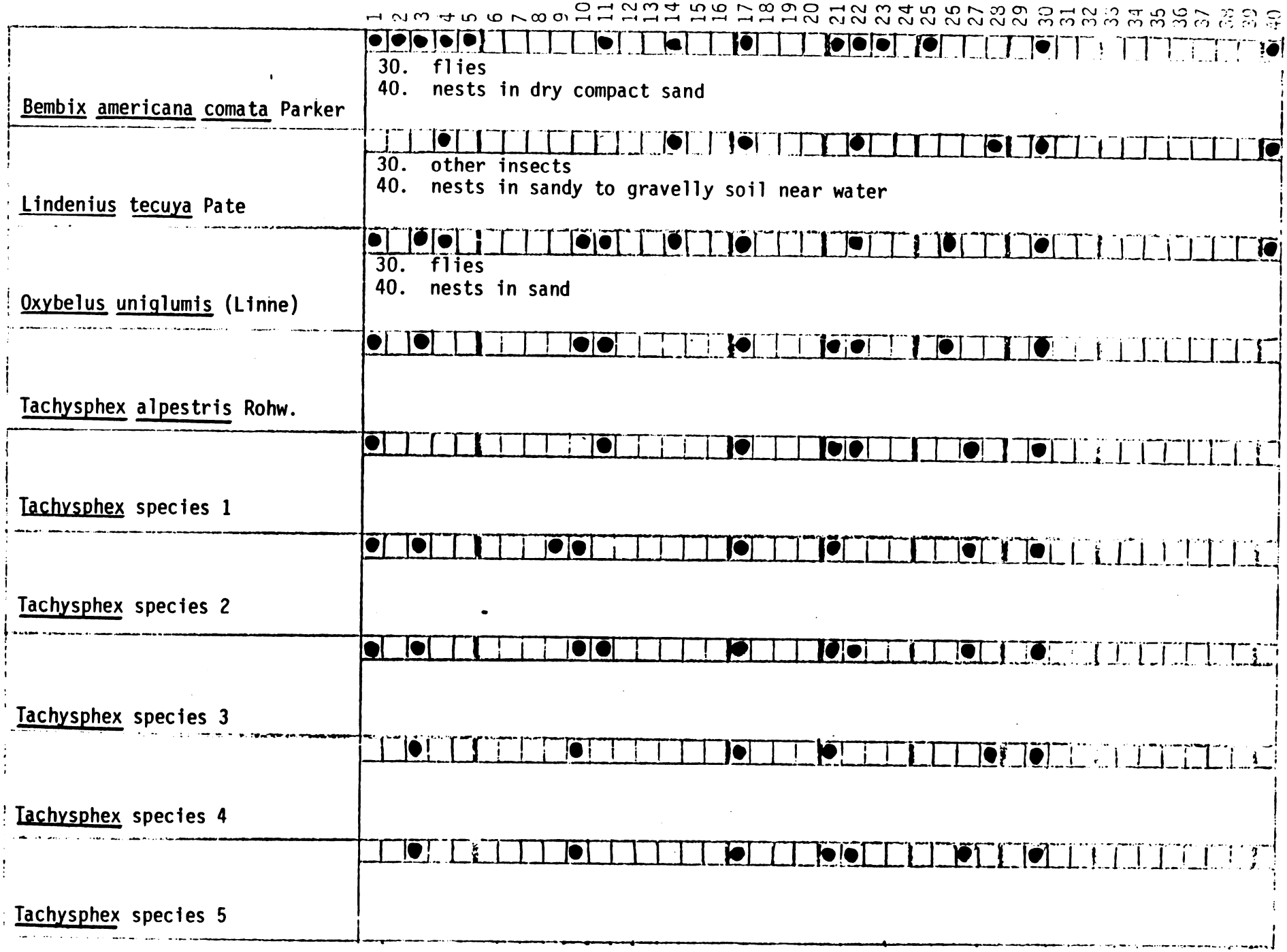

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Scambus species 3
Scambus species 5
Scambus species 6
Scambus brevicornis (Grav.)
Temelucha species 1
Temelucha species 2
Iromatobia ovivora (Boh.)
Iromatobia variabilis (Holm.)
Xanthocampolex species 1

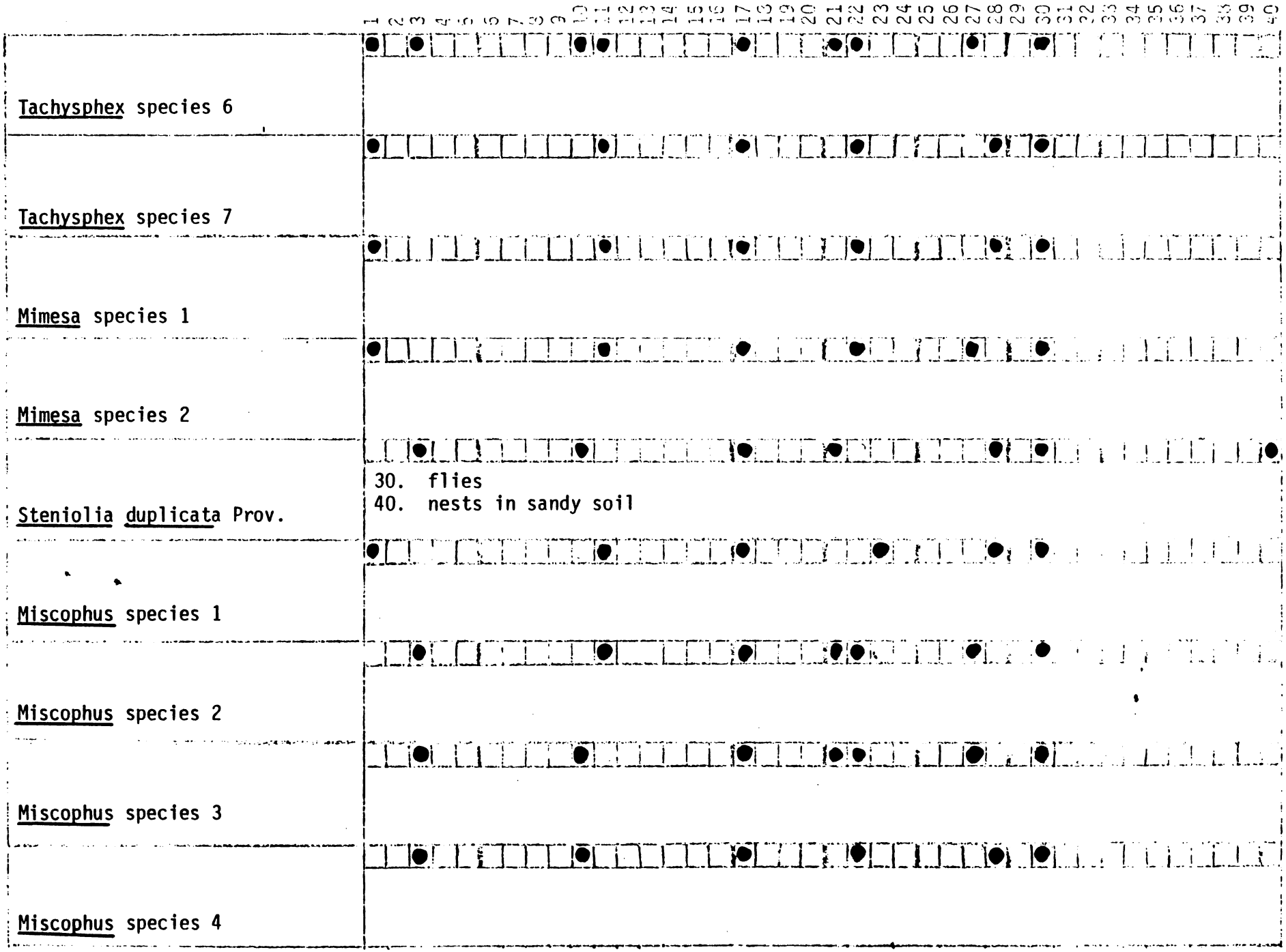

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
Xanthocampolex species 2
Xanthocampolex species 3
Mymaridae
Mymaridae species
Encyrtidae
Encyrtidae species
Pteromalidae
Pteromalidae species
Eurytomidae
Eurytomidae species
Eurytoma species
Chalcidae
Brachymeria species
Spilochalcis species 1

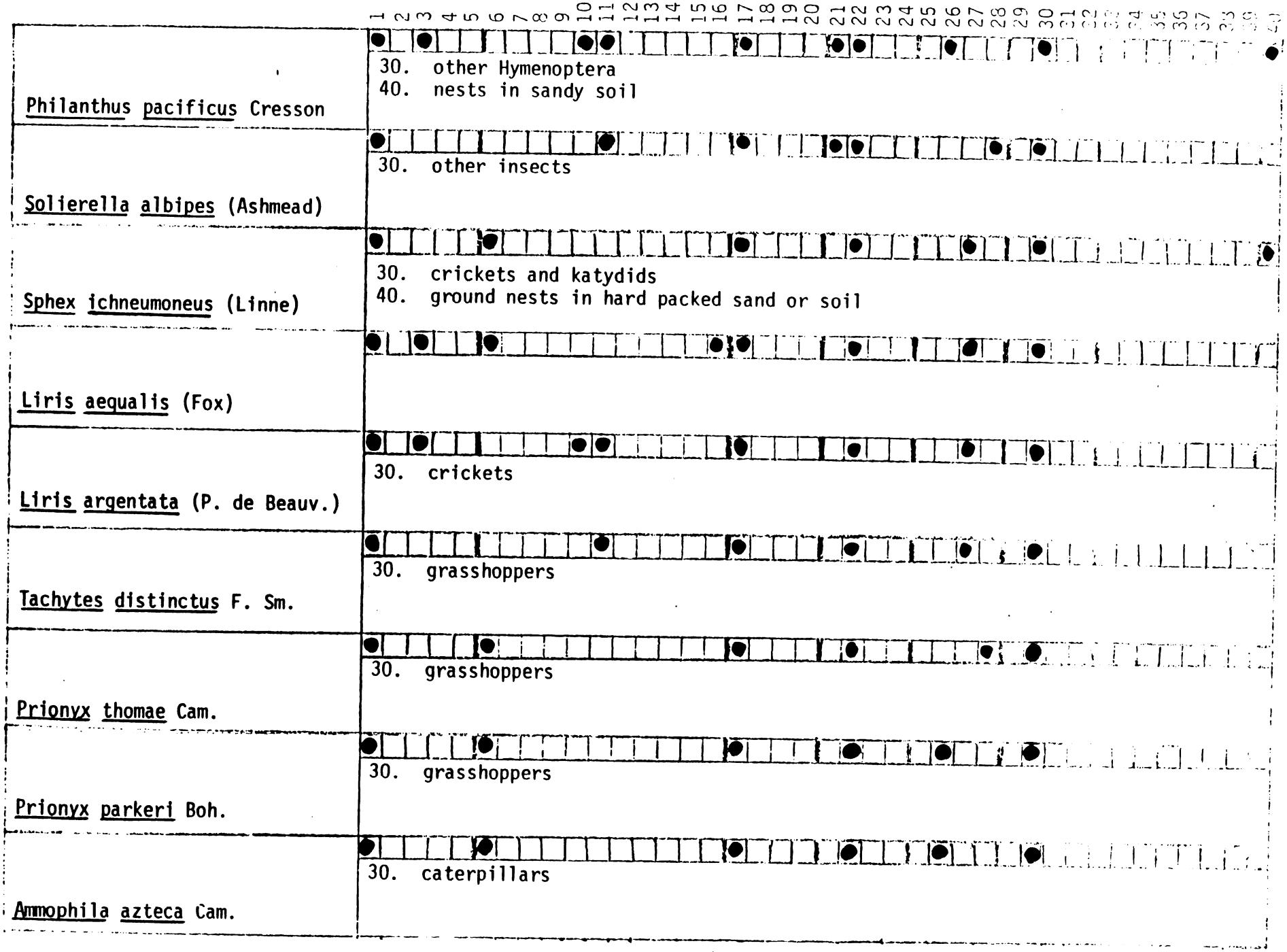

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Spilochalcis species 2
Chrysididae
Chrysis dorsalis Aaron
32. velvet ants (Mutillidae)
Chrysis fuscipes Brulle
Hedychridium species
Tiphiidae
Brachycistis agama (Dalla Torre)
32. beetle larvae
Brachycistis species
40. females wingless, ground dweller
Mutillidae
Sphaeropthalma species
40. females wingless, probably ground dweller
Scoliidae
Campsomeris tolteca (Sauss.)
32. scarab beetle larvae
Formicidae
Pogonomyrmex californica (Buckley)
29. seeds
40. ground nests

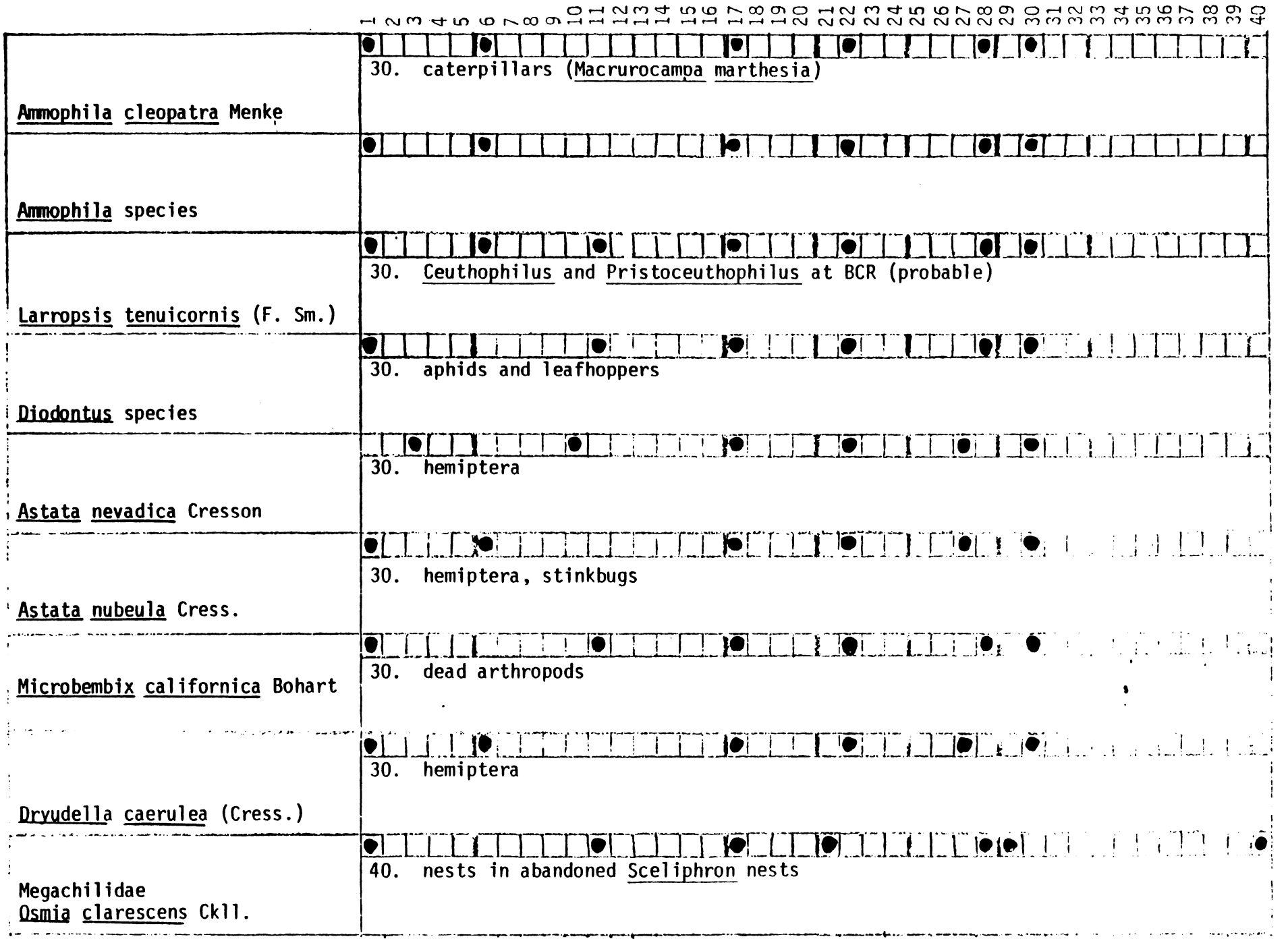

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
17. introduced
40. ground nest, usually under objects
Iridomyrmex humilis (Mayr)
Leptothorax andrei Emery
30. caterpillars
40. hanging paper umbrella nests
Vespidae
Polistes aurifer Sauss.
17. introduced
30. caterpillars
40. hanging paper umbrella nests in trees
Polistes apache Sauss.
40. ground nests
Vespula pensylvanica (Sauss.)
40. nests in old Mud Dauber (Sceliphron) nests
Eumenidae
Ancistocerus tuberculiceps sutterianus (Sauss.)
40. nests in twigs, makes mud cells on rocks
Ancistocerus spilogaster Cam.
Ancistocerus species
30. spiders
40. nests in sand
Pompilidae
Episyon conterminus posterus Fox

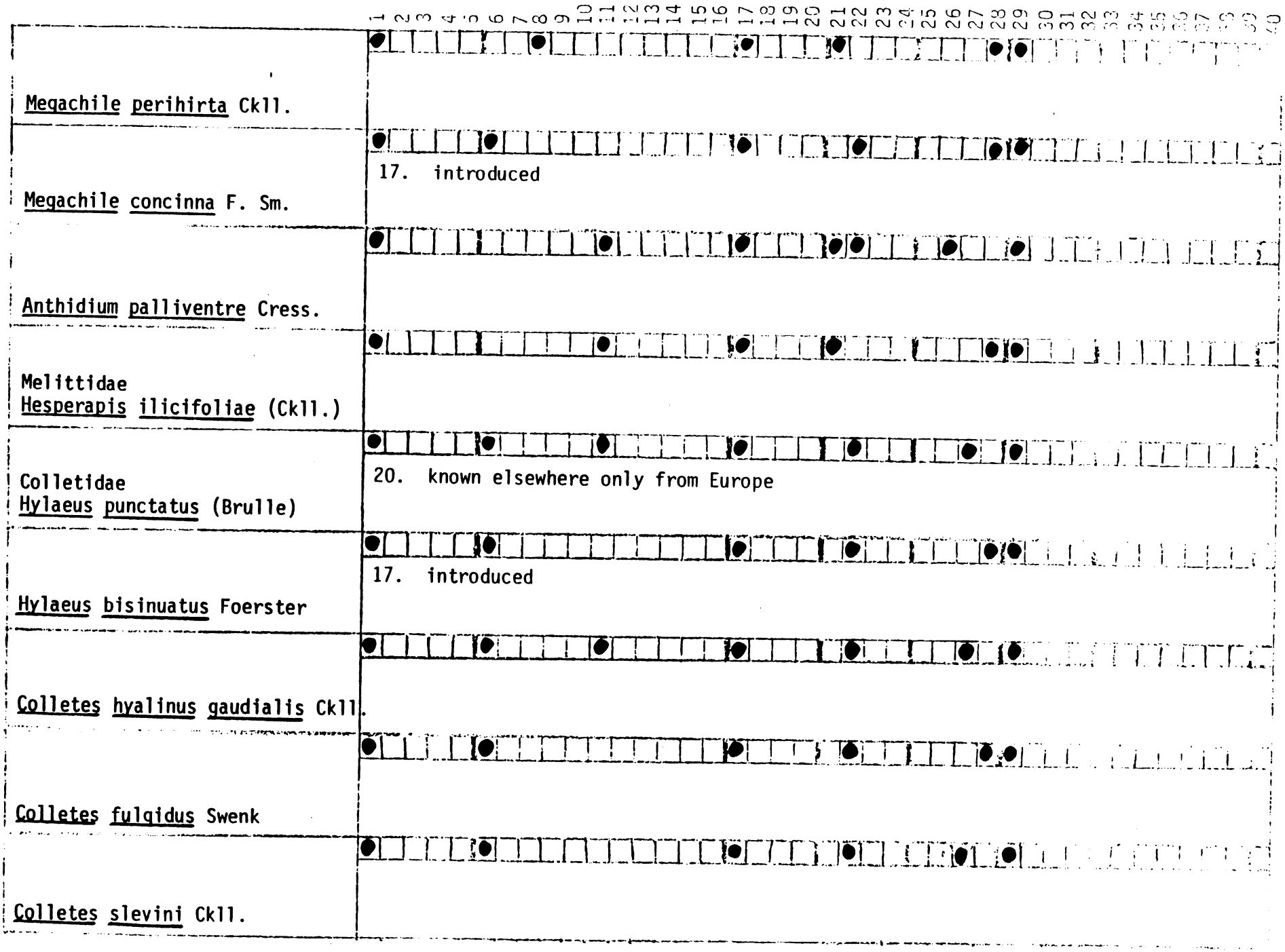
Anoplius imbellis Banks	30. spiders 40. nests in ground near water
Anoplius relativus (Fox)	30. spiders
Episyron quinquenotatus hurdi Evans	30. spiders (*Epeira*)
Pompilus solonus (Banks)	30. spiders (*Lycosa*)
Evagetes species	30. social parasite of other Pompilidae
Evagetes padrinus (Vier.)	30. social parasite *Episyon*, *Anoplius* 40. found in sandy places
Aporinellus taeniatus Kohl	30. probably preys on jumping spiders 40. nests in sand
Aporinellus apicatus Banks	
Sphecidae *Sceliphron caementarium* (Drury)	30. spiders 40. builds mud nests

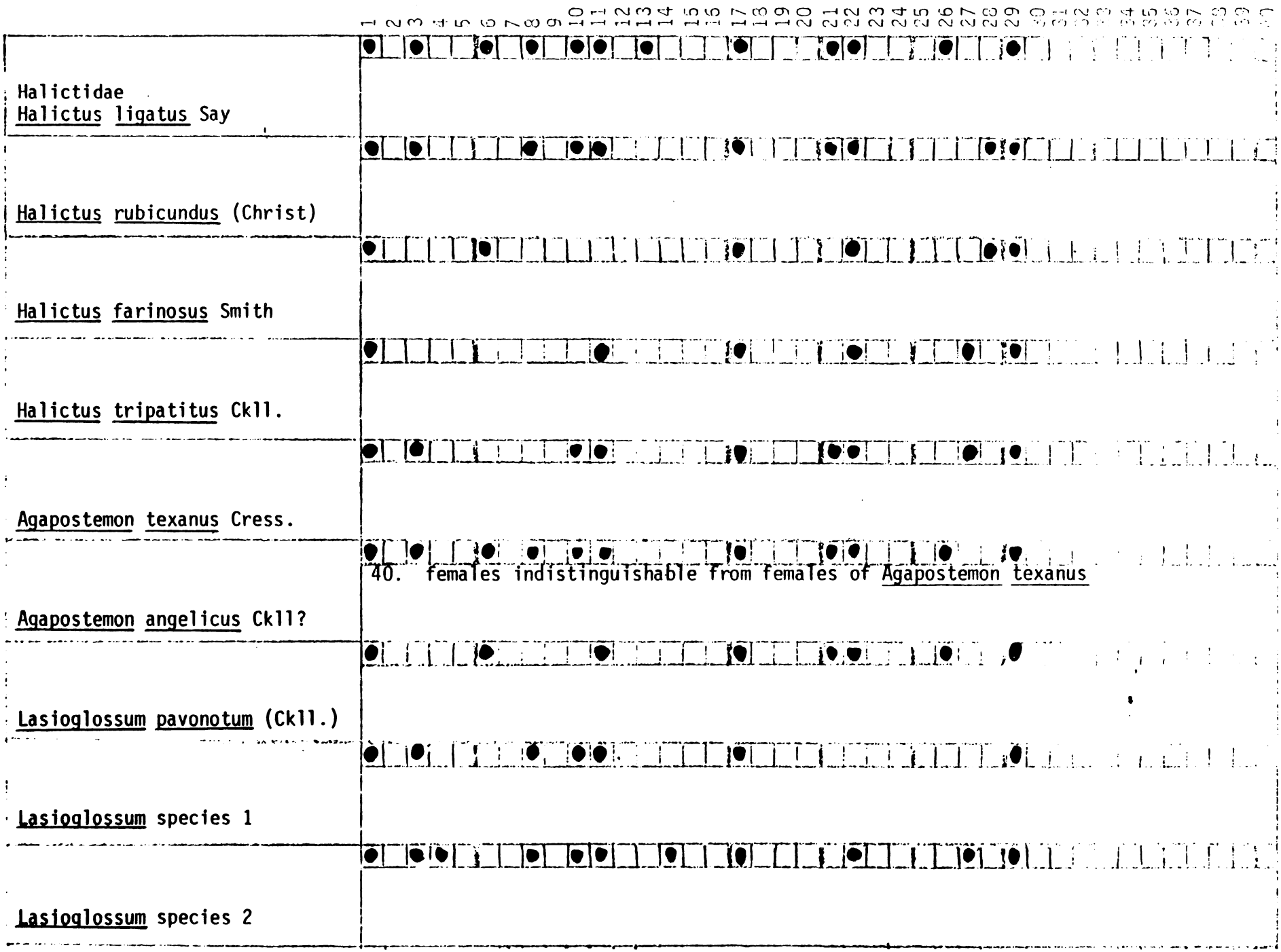

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Bembix americana comata Parker
30. flies
40. nests in dry compact sand
Lindenius tecuya Pate
30. other insects
40. nests in sandy to gravelly soil near water
Oxybelus uniglumis (Linne)
30. flies
40. nests in sand
Tachysphex alpestris Rohw.
Tachysphex species 1
Tachysphex species 2
Tachysphex species 3
Tachysphex species 4
Tachysphex species 5

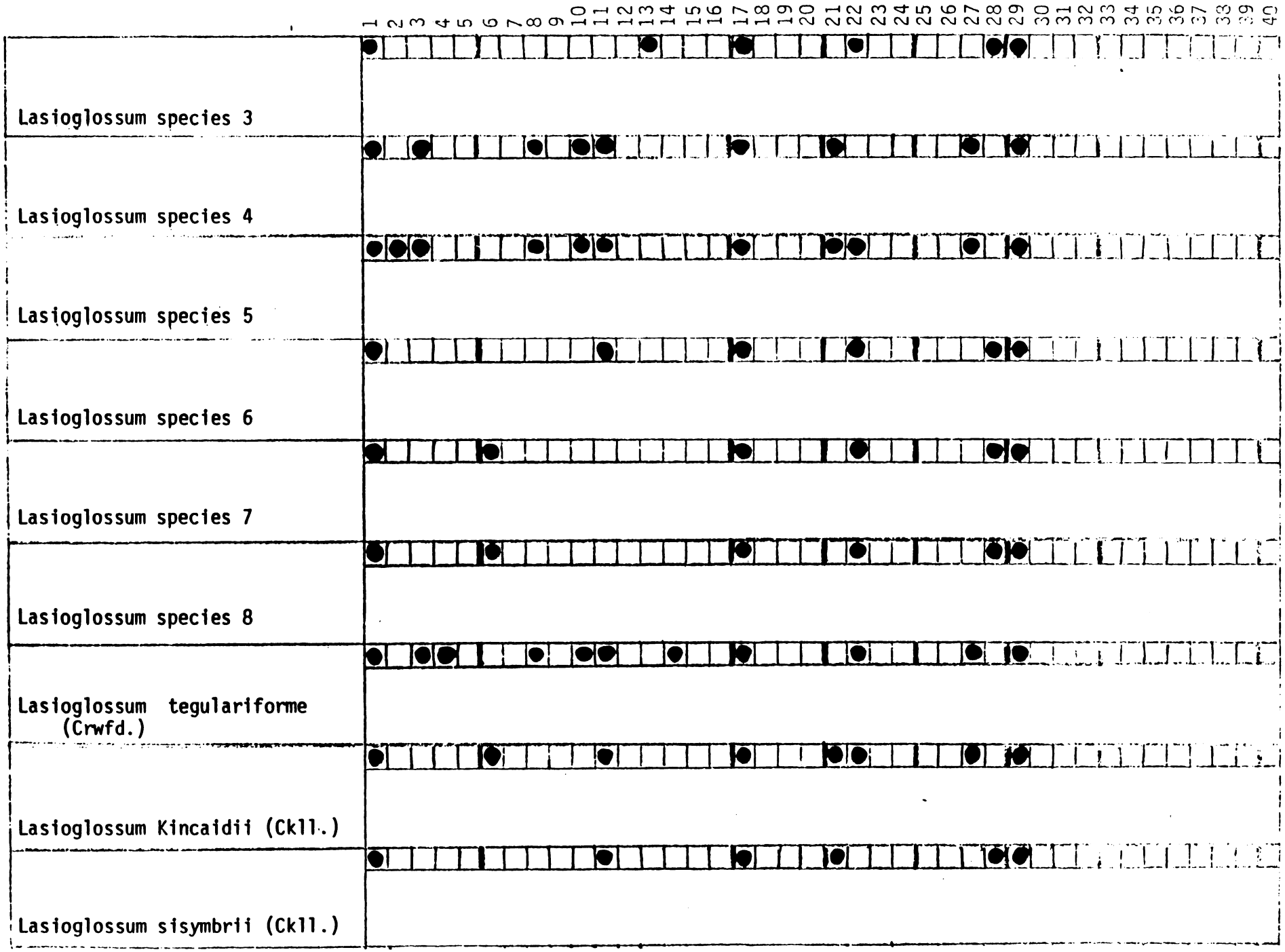

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Tachysphex species 6
Tachysphex species 7
Mimesa species 1
Mimesa species 2
30. flies
40. nests in sandy soil
Steniolia duplicata Prov.
Miscophus species 1
Miscophus species 2
Miscophus species 3
Miscophus species 4

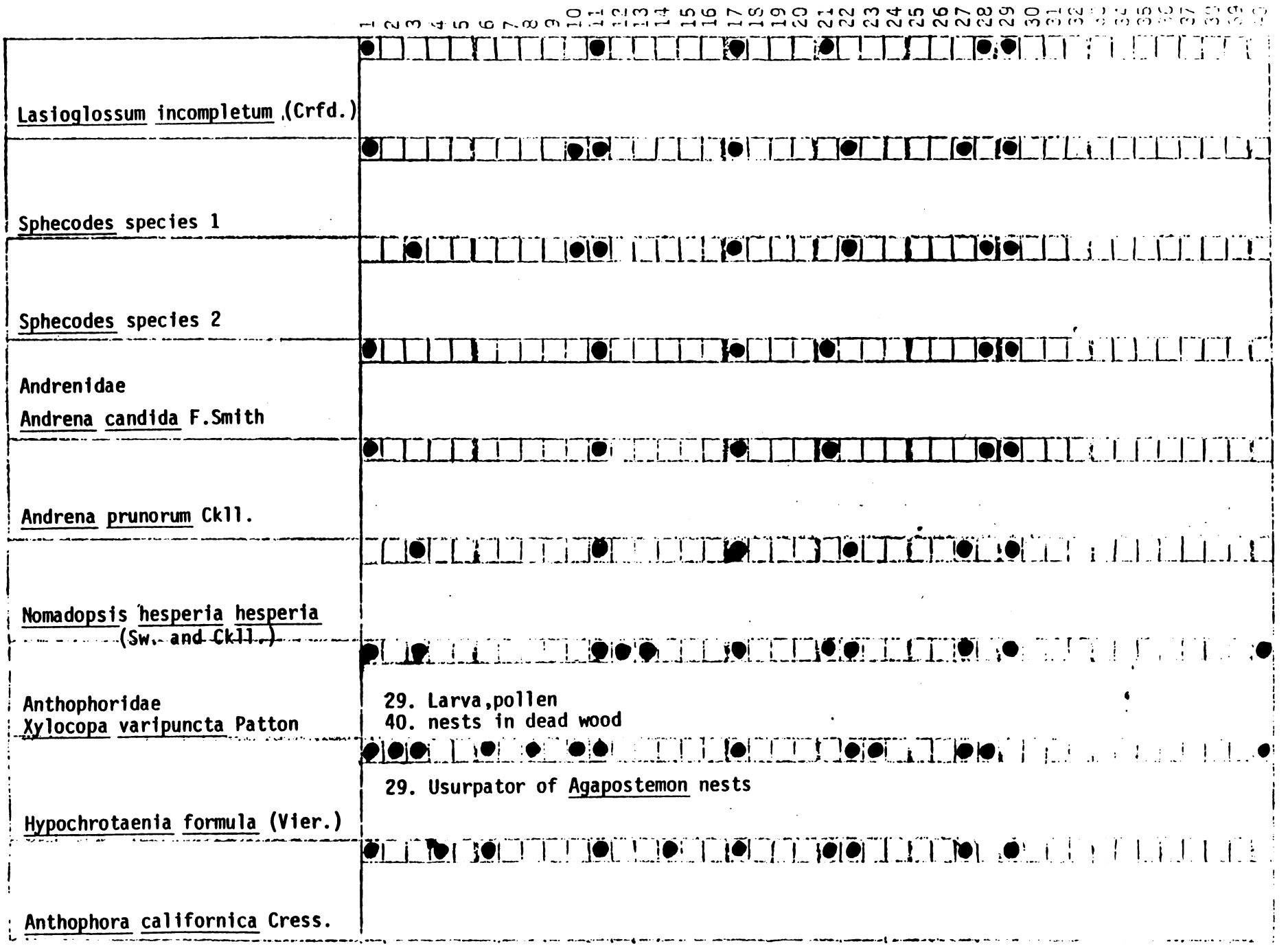

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Philanthus pacificus Cresson
30. other Hymenoptera
40. nests in sandy soil
Solierella albipes (Ashmead)
30. other insects
Sphex ichneumoneus (Linne)
30. crickets and katydids
40. ground nests in hard packed sand or soil
Liris aequalis (Fox)
Liris argentata (P. de Beauv.)
30. crickets
Tachytes distinctus F. Sm.
30. grasshoppers
Prionyx thomae Cam.
30. grasshoppers
Prionyx parkeri Boh.
30. grasshoppers
Ammophila azteca Cam.
30. caterpillars

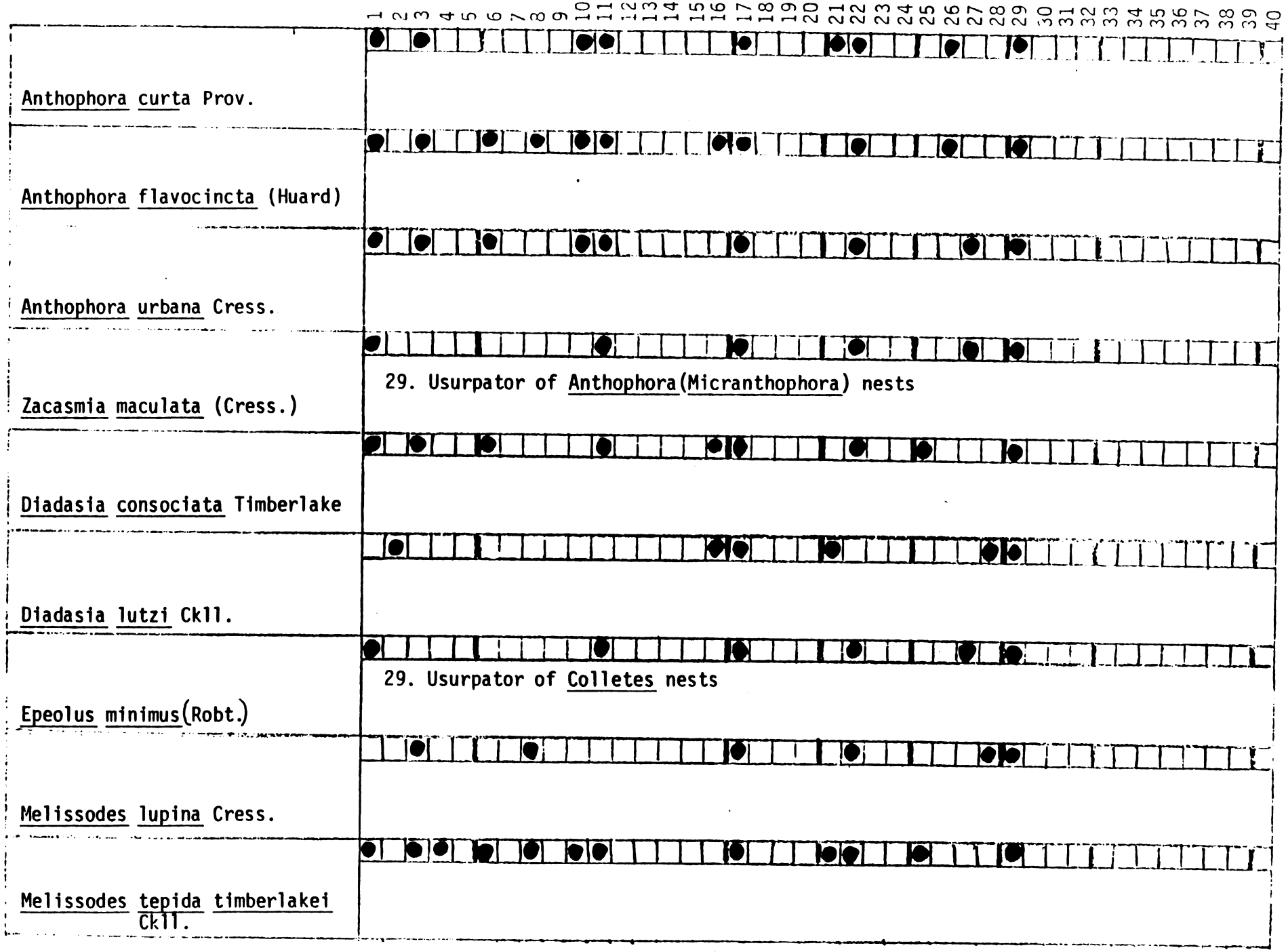

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Ammophila cleopatra Menke
30. caterpillars (Macrurocampa marthesia)
Ammophila species
Larropsis tenuicornis (F. Sm.)
30. Ceuthophilus and Pristoceuthophilus at BCR (probable)
Diodontus species
30. aphids and leafhoppers
Astata nevadica Cresson
30. hemiptera
Astata nubeula Cress.
30. hemiptera, stinkbugs
Microbembix californica Bohart
30. dead arthropods
Dryudella caerulea (Cress.)
30. hemiptera
Megachilidae
Osmia clarescens Ckll.
40. nests in abandoned Sceliphron nests

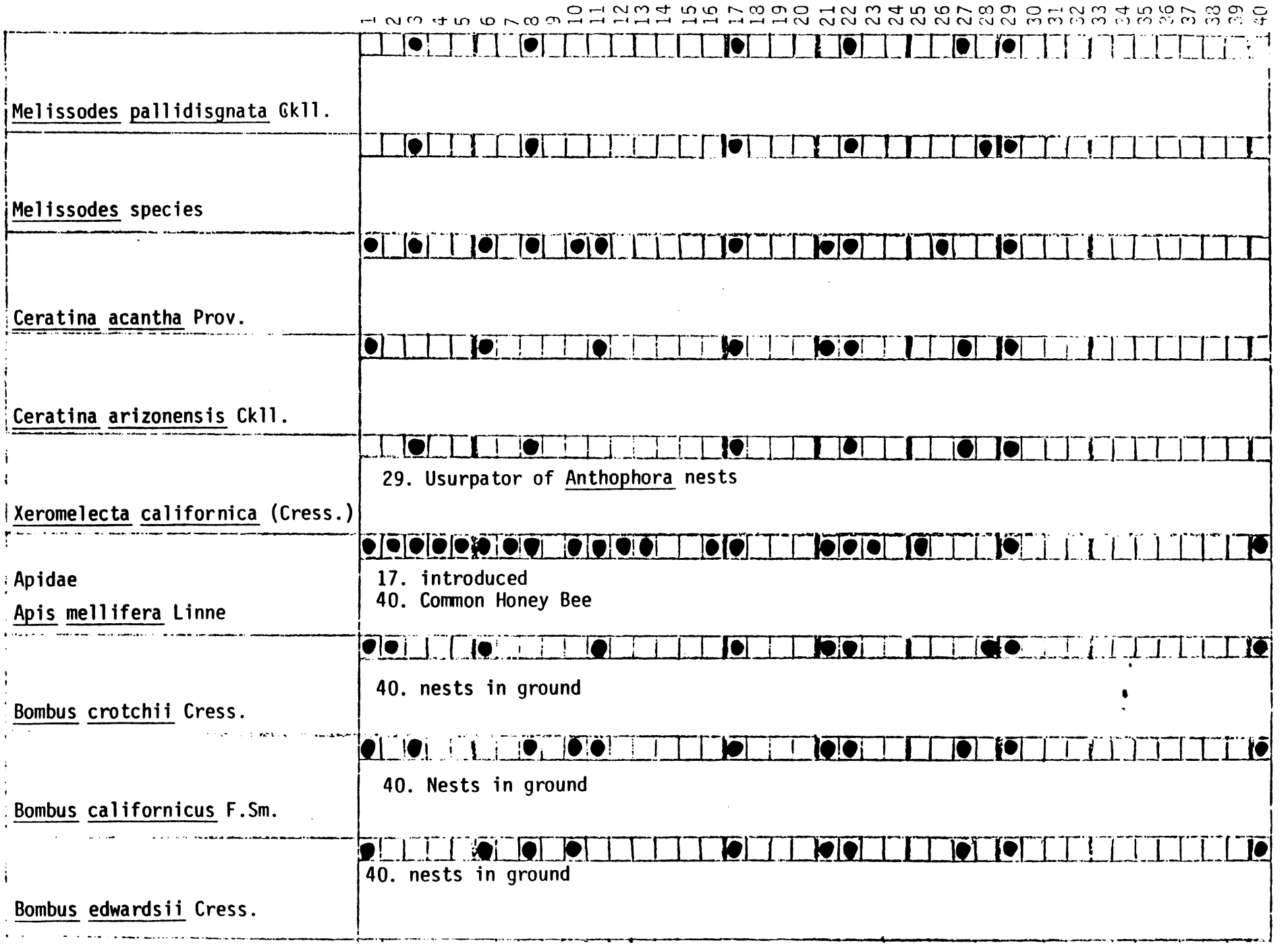

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Megachile perihirta Ckll.
Megachile concinna F. Sm.
17. introduced
Anthidium palliventre Cress.
Melittidae
Hesperapis ilicifoliae (Ckll.)
Colletidae
Hylaeus punctatus (Brulle)
20. known elsewhere only from Europe
Hylaeus bisinuatus Foerster
17. introduced
Colletes hyalinus gaudialis Ckll.
Colletes fulgidus Swenk
Colletes slevini Ckll.

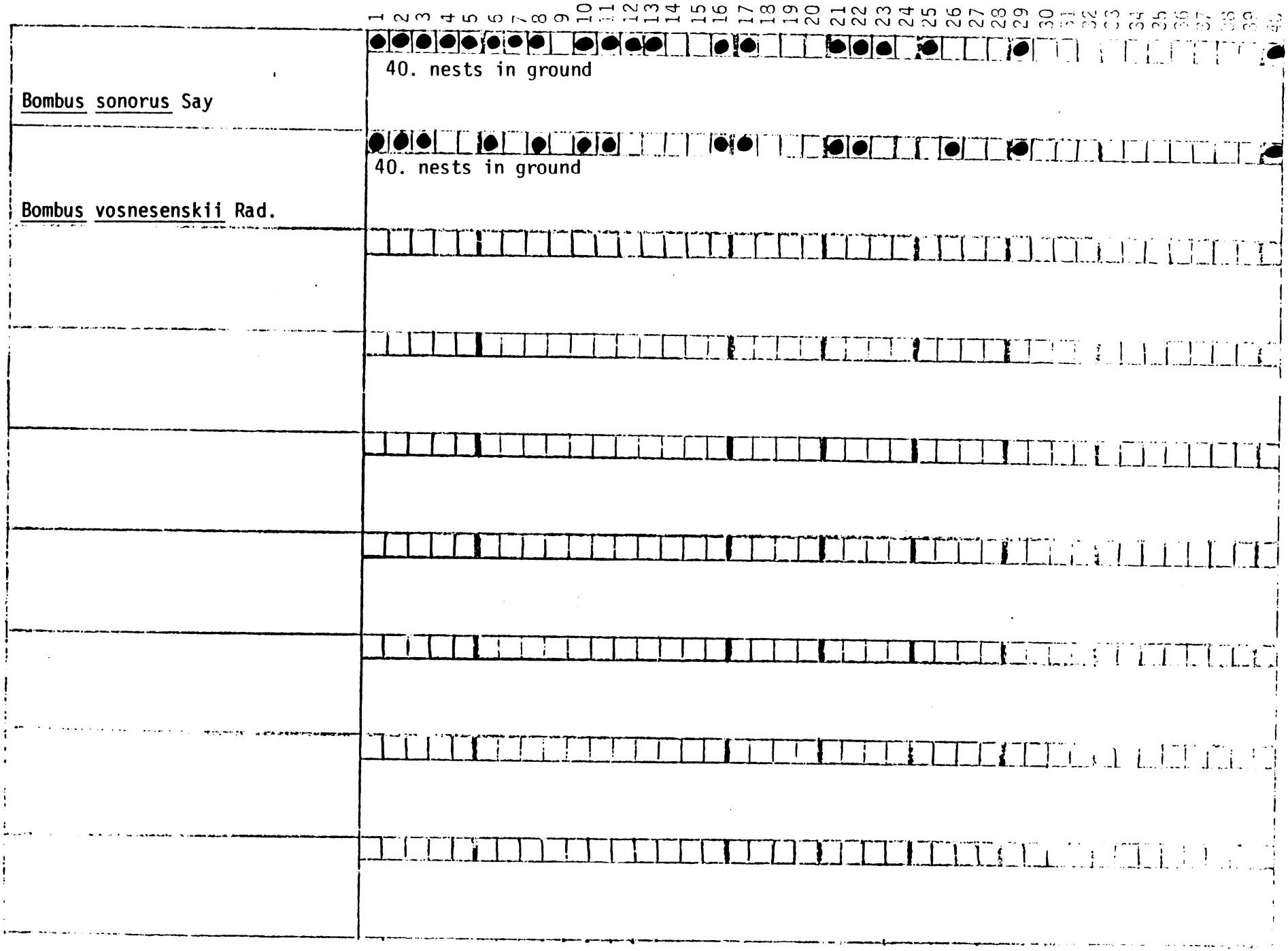

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Halictidae
Halictus ligatus Say
Halictus rubicundus (Christ)
Halictus farinosus Smith
Halictus tripatitus Ckll.
Agapostemon texanus Cress.
40. females indistinguishable from females of Agapostemon texanus
Agapostemon angelicus Ckll?
Lasioglossum pavonotum (Ckll.)
Lasioglossum species 1
Lasioglossum species 2


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Lasioglossum species 3
Lasioglossum species 4
Lasioglossum species 5
Lasioglossum species 6
Lasioglossum species 7
Lasioglossum species 8
Lasioglossum tegulariforme (Crwfd.)
Lasioglossum Kincaidii (Ckll.)
Lasioglossum sisymbrii (Ckll.)


Lasioglossum incompletum (Crfd.)
Sphecodes species 1
Sphecodes species 2
Andrenidae
Andrena candida F.Smith
Andrena prunorum Ckll.
Nomadopsis hesperia hesperia (Sw. and Ckll.)
Anthophoridae
Xylocopa varipuncta Patton
29. Larva, pollen
40. nests in dead wood
29. Usurpator of Agapostemon nests
Hypochrotaenia formula (Vier.)
Anthophora californica Cress.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Anthophora curta Prov.
Anthophora flavocincta (Huard)
Anthophora urbana Cress.
Zacasmia maculata (Cress.)
29. Usurpator of Anthophora(Micranthophora) nests
Diadasia consociata Timberlake
Diadasia lutzi Ckll.
Epeolus minimus(Robt.)
29. Usurpator of Colletes nests
Melissodes lupina Cress.
Melissodes tepida timberlakei Ckll.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Melissodes pallidisgnata Ckll.
Melissodes species
Ceratina acantha Prov.
Ceratina arizonensis Ckll.
29. Usurpator of Anthophora nests
Xeromelecta californica (Cress.)
Apidae
17. introduced
40. Common Honey Bee
Apis mellifera Linne
40. nests in ground
Bombus crotchii Cress.
40. Nests in ground
Bombus californicus F.Sm.
40. nests in ground
Bombus edwardsii Cress.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
40. nests in ground
Bombus sonorus Say
40. nests in ground
Bombus vosnesenskii Rad.

Species List: addendum

The following species of Homoptera have recently been identified; however, no further information is available at this time.

Family Cicadellidae:	Amphigonallia severini DeLong
	Aceratagallia longula Van Duzee
	Prariana sidana (Ball)
	Euscelidius variegatus Kirshbaum
	Graphocephala atropunctata (Signoret)
	Friscanus friscanus (Ball)
Family Membracidae:	Spissistilus festinus (Say)
Family Flatidae:	Mistharnophantia sonorana Kirkaldy
Family Achilidae:	Orgerius triquestris Doering and Darb.
Family Delphacidae:	Pissonotus delicatus Van Duzee
Family Psylliidae:	Psylla curta Tuthill
	Craspedolepta pulchella (Crawford)
	Trioza minuta Crawford
	Trioza maura Forster

Appendix 2

The identifications of the following micro-wasps (Hymenoptera) were received too late to have been included in the entomological analysis of BCR.

Species	Season collected	Unit	Habitat
Ceraphron species A	spring	1	sand dune/willow
Platygaster species A	spring	1	sand dunes/willow
Diapriinae new genus	spring	1	sand dunes
Tetrastichus species	spring	1	sand dunes
Tachinaephagus zelandicus	summer/spring	2/3	weedy field/pickle-weed
Gonatocerus species	spring	1	sand dunes
Ageniaspis species ?	spring	1	sand dunes
Eupteromalus species	spring	1	sand dunes
Torymus species	spring	1	sand dunes
Paraholaspis species	spring	1	sand dunes
Eurytoma species	spring	1	sand dunes
Alloxysta species	spring	1	sand dunes
Pachyneuron species	spring	1	sand dunes
Eridontomerus species	spring	1	sand dunes
Ablaxia species	spring	1	sand dunes
Mesopolobus species	spring	1	sand dunes
Habrocytus species	spring	1	sand dunes
Notoglyptus species? (petiolate)	spring	1	sand dunes
Mesopolobus species (sessile)	spring	1	sand dunes
Hormius species	no further details		
Ephedrus new species (parasite of aphids)	no further details		
Opius new species (parasite of leafmining muscid fly)	no further details		

Appendix 3

Appendix 3 is a letter from the Los Angeles County Mosquito Abatement District in answer to a request for information about possible mosquito problems at BCR.

LOS ANGELES COUNTY WEST MOSQUITO ABATEMENT DISTRICT
12107 W. JEFFERSON BOULEVARD, CULVER CITY, CALIFORNIA 90230 • Phone 827-3448

August 26, 1981

Christopher D. Nagano
Research Asso.
Entomology Section
L.A. County Museum
900 Exposition Blvd.
Los Angeles, CA 90007

Dear Mr. Nagano:

This is in response to your request relative to mosquito breeding which may occur or have occurred in the Ballona Wet-Lands.

There are areas included in the map that have had mosquito breeding at various times. When breeding does occur, appropriate control measures are taken.

Any future development of the area must provide for good water management, provide access for inspections and for appropriate control.

Hoping this will be of assistance to you.

Very truly yours,

Norman F. Hauret

Norman F. Hauret
Manager