Chapter 1:

Introduction

Introduction

The superorder Neuropterida comprises three distinctive orders of holometabolous insects: the Megaloptera, the Neuroptera, and the Raphidioptera and contains about 5,000 described species. Until the recent split of the order Neuroptera into three orders, the true Neuroptera were also called Planipennia. Seventeen extant families are recognized between Plannipenia which include minute insects with a forewing length of about 2 mm (Coniopterygidae) to very large insects with forewing lengths of 70 mm or more (Myrmeleontidae). Most species are moderate-sized insects. The members of Neuropteran order are holometabolous insects in which the families have been grouped by the shape of the larval mandibles. They are short and stout in Ithonidae and Polystoechoetidae (which have subterranean larvae), elongate but straight in the Osmylidae, Sisyridae, Nevrorthidae, Dilaridae, Berothidae and Mantispidae, curved without teeth in the Chrysopidae, Nemopteridae and Hemerobiidae and curved with teeth in the Psychopsidae, Nymphidae, Nemopteridae, Ascalaphidae and Myrmeleontidae. The mandibles of the Coniopterygidae appear to be highly modified which contributes to their phylogenetic isolation from other families. The adults are conservative morphologically with chewing mouthparts, five segmented tarsi and two pairs of wings which have dissimilar venation. Venation is usually dense and complete but can be very reduced, especially in small species. The larvae are unique in that the mandible is grooved to receive part of the modified maxilla to form a sucking 'jaw'. Also, the digestive tube is strange in that the midgut does not empty into the hindgut until the imago emerges from the pupa and deposits a meconium pellet. This is made easier by the fact that food is always taken in liquid form as the larva injects digestive enzymes into the prey to liquefy the tissue. However, they can pass urine. The Malpighian tubules (usually eight in number) are adapted to produce silk which is manipulated by the anal spinneret to construct the silken cocoon. The carnivorous larvae are terrestrial except for the aquatic Sisyridae and some Osmylidae (Stange, 2004).

The Neuroptera were clearly distinct by the Permian, with extant families (Chrysopidae, Coniopterygidae, Nymphidae, Psychopsidae) present in the Triassac Period. Schlüter (1986) recognized an additional 14 families existing in the Mesozoic Era which are now extinct. Although the primitive Neuroptera flourished during the Mesozoic Era, they now appear to be dying out with many families represented by only a few species. Polystoechotidae are now restricted to the Western Hemisphere and are represented by only four species in three genera. The Neurorthidae with about 10 species is found only in the Old World, the Rapismatidae with 16 species limited to the Oriental Region, the Nymphidae with about 25 species restricted to Australia and New Guinea and the Ithonidae with about 17 species limited to Australia and North America. The Nemopteridae and Osmylidae are now absent from North America but both families are represented in the Florissant shales of Colorado (Miocene). The other 10 families have representatives on all continents but even the most speciose families, Chrysopidae and Myrmeleontidae, have only about 1,700 species each.

– Superfamily Coniopterygoidea

– family Coniopterygidae

– Superfamily Ithonoidea

– family Ithonidae

– family Rapismatidae

– family Polystoechotidae

– Superfamily Osmyloidea

– family Dilaridae

– family Neurorthidae

– family Osmylidae

– family Sisyridae

– Superfamily Mantispoidea

– family Berothidae

– family Mantispidae

– Superfamily Hemerobioidea

– family Chrysopidae

– family Hemerobiidae

– Superfamily Myrmeleontoidea

– family Ascalaphidae

– family Myrmeleontidae

– family Nemopteridae

– family Nymphidae

– family Psychopsidae

The family Coniopterygidae contains the pygmies of the order with the fore-wing length ranging between 2 to 6 mm and are called dusty wings. Although considered rare for many years because of their size, they often are among the most abundant Neuroptera in many habitats, living on trees and shrubs although the aberrant Brucheiserinae evidently live under stones. The body, wings, and legs often are coated with white or grey wax secreted by hypodermal glands. The antenna has 15 to 62 segments with the flagellar segments moniliform, often with scale-like hairs in distinct whorls in the males. The wings are held roof-like over the body. The hind-wing usually is smaller than the fore-wing, sometimes greatly reduced, and the venation is highly reduced. There are never more than two basal costal cross-veins, the fore-wing Sc is forked distally and the posterior branch resembles the distal part of R1; radial sector separating from R1 near middle of wing, often forked and the posterior branch sometimes resembling the distal part of medial vein. The tarsus is distinctive in the order although similar to those of the Sialidae in having the fourth segment modified (flattened and bilobed). The abdomen lacks the spiracle on the eighth segment which is apomorphic and distinctive among the Neuroptera. The genera usually are separated by wing venation, whereas examination of the male genitalia usually is required to identify the species. The larvae are active predators, often feeding on mites, but they also feed on other small, soft-bodied insects in their environment. They have a large head but the mouthparts are mostly concealed and consist of a short labial palpus with the apical segment expanded, short, straight and pointed styles. The eyes consist of 4 to 5

stemmata. There are about 490 described species in about 30 genera in three subfamilies and is the fourth most speciose family in the order. The aberrant Brucheiseridae are found in arid areas of Argentina and Chile and consist only of the genus *Brucheiser* with several species. These apparently are flightless insects with highly sclerotized, reticulate wing venation. Their biology is unknown. The Aleuropteryginae is mostly cosmopolitan although the genera are not. They possess peculiar and unique structures on the abdomen called plicaturae. These are paired organs which are strongly folded and placed on an oblong, somewhat membranous area. Their function is unknown. Also, the wing venation differs from the other subfamilies in having two radio-medial cross-veins in the middle of the wing. The larvae have the mouthparts projecting from beneath the labrum and the antenna is about as long as the labial palpus. There are about 14 genera classified in three tribes. The most common are *Aleuropteryx* (Holarctic), *Neoconis* (Neotropics) and *Spiloconis* (Australia). The Coniopteryginae have two speciose, cosmopolitan genera, *Coniopteryx* Curtis and *Semidalis* Enderlein (except Australia). The members of this subfamily lack plicaturae and have only one radio-medial cross-vein. Often the males have scale-like setae on the antennae and a few species have a hook on the frons. This subfamily is the most commonly collected and of great biological control interest since many species live on economic crops such as citrus. The vast majority of coniopterygids fly at dawn or dusk, fluttering slowly between plants where they lay eggs. Many species are specific to certain types of plants like junipers (Stange, 2004).

The family Ithonidae is similar in appearance to the Rapismatidae but are whitish to brownish in coloration and commonly live in arid regions. They hold their wings relatively flat over the back which is unusual in the order and resemble dull hepialid moths both in appearance and in flight, which has led to the common name ‘moth lacewings’ for this family. The fore-wing ranges from about 15 to 30 mm. Three monotypic genera occur in the southwestern United States (*Oliarces* Banks), in Mexico (*Narodona* Navás) and in Honduras (*Adamsiana* Penny). Elsewhere, they are found only in Australia (about 24 species in *Ithone* Newman, *Megalithone* Riek and *Varnia* Walker). Ngymata (slightly domed, bare areas on the wing) are found in this family and are of unknown function; similar structures are found in other families of Neuroptera, as well as Trichoptera, Megaloptera and Mecoptera. Claims have been made that the subterranean larvae are predacious on Scarabaeidae grubs but this has not been clearly established. Some species of ithonids (*Ithone*, *Megalithone* and *Oliarces*) have been observed swarming in vast numbers for short periods of time. In most cases, the swarming sites have been detected first by the presence of many frenzied birds which have a feast when these fat, hapless insects are swarming. The adults can run fairly quickly and lay their eggs in the sand by means of a ‘sand plough’ (Stange, 2004).

The family Polystoechotidae is another family of robust sized insects and superficially similar to the Ithonidae and Rapismatidae. The fore-wing ranges from 15 to 40 mm. There are only four species known in three genera. The genus *Polystoechotes* Burmeister has one species in Chile and another in North America. The genus *Platystoechotes* Carpenter is limited to the Sierra Nevada of California and Oregon where it may be associated with *Libocedrus* (incense cedar). The third genus, *Fontecilla* Navás, lives in arid zones in central Chile. Little is known of the biology of this family although the larva has been described. They are subterranean but claims that they feed on plant roots are unsubstantiated. *Polystoechotes punctatus* (F.) was once commonly distributed through the northern half of the United States. The reason why this species is now restricted to the

southwestern United States south to Central America is unknown. Apparently this species is attracted to smoke and all the species are attracted to light.

The family Rapismatidae is found in the Oriental region. These large, sturdy lacewings with complex venation are usually greenish to yellowish in coloration and live in mountainous areas. The fore-wing ranges from about 20 to 36 mm. There are about 20 species, all in the genus *Raspisma* McLachlan. These insects are relatively rare in collections and little is known about their biology (Stange, 2004).

The family Osmylidae is a relatively large family of lacewings with about 170 species in about 20 genera. The classification is suspect with eight subfamilies recognized based on simplistic wing venational characters. They are found on most continents except North America. The species are moderate sized insects (forewing 15 to 30 mm long). Nearly all the species have three ocelli and usually two wing pygmata (sometimes faint) which helps define the family (Stange, 2004).

The family Dilaridae consists of small delicate lacewings (forewing length 4 to 15 mm) and are easily distinguished in the male by the plumose antenna and in the female by the well developed ovipositor. The known larvae are elongate and live in burrows in wood, probably feeding on beetle larvae. There are 67 described species in two subfamilies which are nearly exclusive geographically. The Dilarinae are found only in the Old World (except Australia), and the Nallachiinae are found only in the New World except for recently discovered species in South Africa and India (Stange, 2004).

The family Sisyridae is a small family with about 30 species in four genera. *Sisyra* Burmeister is cosmopolitan and the large genus *Climacia* McLachlan is found only in the Western Hemisphere. Two other genera exist but are of doubtful validity and with few species in the Old World. These are small insects (forewing length 4 to 10 mm). The female has the terminalia elongated into an ovipositor like structure. The wings have relatively few cross-veins and there are small thickenings (trichosors) on the posterior margin of the distal half of the wings. They are most easily confused with the Hemerobiidae. The larvae are aquatic and feed on freshwater sponges and probably Bryozoa. The larval jaws are the longest in the order, apparently adapted for sucking out the contents of sponges. They are called Spongilla-flies for this reason. They are the only truly aquatic insects in the order with the larvae bearing external gills in the second and third instars. The larvae leave the water to pupate, usually constructing a distinctive double cocoon with a mesh-like covering. The adults are predacious on insect eggs and small insects (Stange, 2004).

The family Neurorthidae used to be included in the Sisyridae until the terrestrial larvae were discovered and found to be greatly different morphologically. This small family of delicate lacewings (forewing length 6 to 10 mm) consists of only 10 species found in Europe and North Africa (*Neurorthus*), Asia (*Nipponeurothus*) and Australia (*Austroneurothus*). There is some data suggesting that this family is not closely related to other families of the order (Stange, 2004).

The family Berothidae, or beaded lacewings, is another family &(about 110 species&) of small (forewing length 6 to 15 mm), delicate lacewings occurring on all continents (except Antarctica). Many species have falcate wings and some species have scale-like setae on the wings and sometimes on the body (*Lomamyia* Banks*)*. There are trichosors present on the wing margins. The family is difficult to define and usually keys out at the end of the family key on venational characters. There are four distinct subfamilies. The Rhachiberothinae are found only in southern Africa and have the forelegs raptorial. There are two genera. The Cyrenoberothinae contains one monotypic genus from Chile (*Cyrenoberotha* Adams & MacLeod) and one monotypic genus from southern Africa (*Manselliberotha* Aspöck & Aspock). Nothing is known of their biology. The adults have the face elongated below the

eyes. The Nosybinae contains only one genus, *Nosybus* Navás, known only from Africa. The wings are rounded and have small venational differences from the Berothinae. The Berothinae is the largest subfamily with about 24 genera in all continents. The life cycle of the North American genus, *Lomamyia* Banks, has been described. The larvae live in termite burrows. In one species the first instar waves its abdomen at a termite releasing an 'allomone' which paralyzes the termite in a few minutes. Later instars can produce enough gas to immobilize up to six termites per shot (Stange, 2004).

The family Mantispidae, containing about 350 described species, are easily recognized by having raptorial forelegs and thus can be confused only with the subfamily Rhachiberothinae of the Berothidae in the Neuroptera. The larvae are hypermetamorphic, being very active triungulins in the first instar, and becoming inactive scarabaeiform larvae in subsequent instars. Adults of the same species can vary greatly in size since most species are parasitic on spiders. The fore-wing can vary between 5 to 30 mm. The pronotum is sometimes many times longer than wide and, in contrast to the snakeflies, the legs originate near the anterior margin. There are four subfamilies. The Drepanicinae is found in Chile and Australia and contains the largest species of the family, *Drepanicus gayi*, from Chile which is green and somewhat leaf-like. The genera *Ditaxis* McLachlan and *Theristria* Gerstaecker are found only in Australia; the latter is the most diverse mantispid genus in Australia. The biology of this subfamily is unknown. The Calomantispinae is a small subfamily with only two genera, *Nolima* Navás (North America) and *Calomantispa* Banks (Australia). The larvae of *Nolima* may be generalist predators. The Symphrasinae is a New World subfamily containing three genera, *Anchieta* Navás, *Plega* Navás, and *Trichoscelia* Westwood. The latter genus has been reared out of larval cells of *Polybia* (Vespidae). The larvae of *Plega* appear to be generalist predators with prey records including the pupae of Noctuidae and Scarabaeidae and the cells of a leaf-cutting bee (*Megachile*). Many of the species of *Anchieta* resemble bees. This subfamily has a well developed ovipositor and possesses other characters which isolate it especially from the largest subfamily, Mantispinae. All of the Mantispidae are 'parasites' of spider egg sacs. The triungulins either board the female spider until she makes her egg sac or directly searches for the egg sac without phoretic behavior. This varies between species. Some species of Mantispinae resemble vespoid wasps such as *Cimaciella* Enderlein in North America and *Euclimacia* Enderlein in the Oriental regions. These mantispids show considerable variations in color pattern throughout their ranges probably in relation to the variation of the wasp models. Adults are active predators and usually are found in trees and shrubs. They are attracted to light. The genus *Mantispa* Illiger was once thought to be widespread but apparently is paraphyletic and absent in the New World and Australia. The present number of genera is about 30 but some other genera appear to be undescribed (Stange, 2004).

The Chrysopidae is probably the largest family of the Neuroptera with more than 1,300 described species in 75 genera and three extant subfamilies. Although called green lacewings, there are many species which are brownish in coloration, especially species that rest on rocks during the day. Also, the greenish color of museum specimens often fades in a few years. The adults lack microtrichia on the wing membrane found in most families of Neuroptera. Nearly all the species possess a tympanal organ on the ventral base of the radial vein. One function of this auditory organ is to detect bat echo-locating sounds, that once identified, will signal the adults to fold their wings and drop to the ground. This family contains the most significant biological control agents in the order, and species of *Chrysoperla* Steinmann are sold worldwide for biological control. The larvae are active predators living on plants and feed on diverse, soft-bodied insects, especially aphids. The most plesiomorphic subfamily appears to be the Nothochrysinae with about 20 species in

seven genera found in Australia (*Dictyochrysa* Esben-Petersen, *Triplochrysa* Kimmins), Europe (*Hypochrysa* Hagen, *N thochrysa* McLachlan), Africa (*Kimochrysa* Tjeder, *Pamochrysa* Tjeder), and North America (*Nothochrysa* McLachlan, *Pimachrysa* Adams). These are mostly robust and moderate sized insects, often dark brown in color and lack the tympanal organ. They seem to live in forests of ancient trees (such as Gymnosperms). The Apochrysopinae contain the giants of the family (forewing length 18 to 34 mm) and represent a small group with about 25 species in 12 genera. Like the Nothochrysopinae, the genera are limited in distribution such as to Australia (two genera), South America (four genera), Africa (two genera) and Asia (four genera). They appear to prefer the dark areas of dense forests. The Chrysopinae are by far the largest subfamily with more than a 1,000 species in nearly 70 genera. Many genera are now cosmopolitan partly because species of *Chrysopa* Leach, *Ceraeochrysa* Adams, and *Chrysoperla* Steinmann have been released and established in diverse regions of the world. The adults of some of these genera (i.e., *Chrysoperla*) feed on honeydew and employ extracellular symbiotic yeasts to aid in digestion. Many genera (i.e., *Ceraeochrysa*, *Leucochrysa* McLachlan) have trash bearing larvae. Special species communication occurs in the family. Some adults (i.e., *Chrysoperla*) move the abdomen rapidly, transmitting by way of the legs to the substrate a vibration (tremulation), and in the genus *Meleoma* Fitch stridulation is accomplished by moving the hind femur against abdominal sternites. The larvae have long, strong, curved mandibles (no teeth) similar to those of the Hemerobiidae and can be distinguished by the presence of the trumpet like empodium between the tarsal claws. Nearly all species lay their eggs on stalks, either separate stalks or stalks stuck together at the base, which may help to keep emerging larvae from eating each other (Stange, 2004).

The Hemerobiidae consists of about 500 species in 28 genera and 10 subfamilies. Nearly all species are yellow to dark brown in color but there are a few green species. The species can be distinguished from those of other families by the presence of at least two apparent radial sectors except for the monotypic genus *Adelphohemerobius* Oswald from Chile. The family appears most closely related to the Chrysopidae but differs notably from that family in possessing microtrichia on the wing membrane. Many species are relatively small (forewing length 4 to 10 mm) but a few species attain 18 mm in wing length. The biology of the family seems similar among the different genera and are similar to those of the Chrysopidae. Larvae of Hemerobiidae lack the trumpet-shaped empodium in instars 2 and 3 but have similar shaped ‘jaws’ which are curved and without teeth. This family is important in biological control with most of the larvae being active predators on mostly soft bodied insects and mites on plants. Several genera are cosmopolitan or very widespread (i.e., *Hemerobius* L, *Micromus* Rambur, *Notiobiella* Banks, *Sympherobius* Banks, *Wesmaelius* Krüger) whereas most are restricted to one biogeographical realm (eight genera restricted to South America; five genera to Australia). This family demonstrates an unusual amount of wing reduction with flightless species of *Micromus* in Hawaii and of *Conchopterella* on the Juan Fernandez Islands. *Psectra diptera* Burmeister has forms with only one pair of functional wings (Stange, 2004).

The Psychopsidae, or ‘silky lacewings’ contains 26 species in five genera and two subfamilies. The Zygophlebiinae is restricted to southern Africa and contains three genera (*Silveira* Navás, *Cabralis* Navás and *Zygophlebius* Navás). *Balmes* Navás (Oriental region) and *Psychopsis* Handlirsch (Australian) belong to the Psychopsinae. These are moderately large lacewings with broad wings and dense venation (forewing length 10 to 35mm). Biology and larval stages are poorly known. *Cabralis gloriosus* Navás is a mostly white

species which flutters around in fairly dense and spiny vegetation. *Silveira* contains four relatively small species living mostly in arid zones(Stange, 2004).
The Nymphidae are found only in Australia and New Guinea. There are about 25 species in eight genera. The Myiodactylinae contain very broad winged lacewings which lack tibial spurs whereas the Nymphinae contains more narrow winged lacewings with short tibial spurs; *Nymphes myrmeleonoides* Leach resembles some antlions and owlflies in overall appearance but have filamentous antennae. The larvae have strongly curved mandibles, usually with one tooth. There are two types of larvae known. Those of the Myiodactylinae (*Myiodactylus* Brauer; *Osmylops* Banks are strongly flattened and presumably relatively immobile as in most Ascalaphidae. The larvae of *Nymphes* are more antlion-like, being narrower and searching for prey among litter and vegetation (Stange, 2004).
The Myrmeleontidae currently have the most described species (about 1,700) in the order with 188 extant genera, 15 tribes and three subfamilies. They are found on all continents but are most abundant in xeric areas since the larvae live in sand or loose soil. The adults are small to large (forewing 10 to 75 mm) with characteristic wing venation with an elongate cell under the stigma, and the male of many groups has a special gland at the base of the forewing ('pilula axillaris'). Antlions are closely related to the Ascalaphidae but lack the elongate, clubbed antennae of that family The larvae are distinguished from other Neuroptera larvae in having the hind tarsal claws much larger than those of the other legs which is an adaptation for burrowing. Studies have shown that the larvae have preferred habitats and some live under the protection of rock overhangs or in tree holes or animal burrows, but the majority live in open sand. Some prefer coarser sand than others, and members of the tribe Myrmeleontini construct pitfall traps, whereas most others do not. Exceptions occur in the Brachynemurini (i.e., *Scotoleon pallidus*), Nesoleontini (*Cueta* Navás) and Myrmecaelurini (*Isoleon* Esben-Petersen; *Myrmecaelurus* Costa); these larvae construct a double structured pitfall trap (funnel shaped pitfall below which is a tubular extension) in hard pan soils. Members of *Callistoleon* Banks (Myrmeleontini) have side furrows to the pitfall trap. There are three extant subfamilies. Palparinae contains the giants of the family with the fore wing length reaching 75 mm. All live in the Old World (except Australia) except for a small group (Dimarini) in South America. One member of the Dimarini, *Millerleon pretiosus* Banks, has larvae that live in extreme desert conditions and can survive in the larval stage for more than five years and can survive many months without feeding. The palparine larvae have enlarged setae distally called fossoria which enable the bulky larvae to dig more efficiently. They have been observed to capture ground resting grasshoppers. The Stilbopteryginae is a small subfamily of large antlions with short, knobbed antennae (similar to *Albardia* of the Ascalaphidae) restricted to Australia (two genera). The Myrmeleontinae contains more than 90% of the genera and species in about eight tribes. The Nemoleontini is the largest tribe, found on all continents, and most genera have similar biologies. However, a few genera (i.e., *Navasoleon* Banks) have larvae that live on bare rock surfaces. These larvae can remain motionless for weeks. Species of *Gatzara* of the tribe Dendroleontini, also live on bare rock surface and cover themselves with green lichens for camouflage. Most known larvae of the Dendroleontini have a debris carrying bunch of setae on the metascutum which apparently lures prey. All larvae of the tribe Myrmeleontini and a few genera of the tribe Acanthaclisini move only backwards. Perhaps the most striking species of antlion, *Pseudimares iris* Kimmins of the monospecific tribe Pseudimarini is large, with a large eyespot on the hindwing and has been collected only one from southern Iran. All the larvae and nearly all the adults are predacious on other insects. A few adults apparently feed on pollen. Most adults are

nocturnal but there are a few day-flying species, such as the butterfly-like species of *Pamexis* Hagen from South Africa and *Maracandula* Currie from Mexico (Stange, 2004).

The owlflies, or Ascalaphidae, contain mostly fast flying insects that resemble dragonflies. Adults are moderate to large in size (forewing length 15 to 60 mm), robust and usually very pilose with huge compound eyes which suggested the common name. There are about 500 species in about 80 genera and three subfamilies on all continents (except Antarctica). They are mostly crepuscular aerial predators and sometimes swarm in flight. Nearly all species have elongate antennae which are clubbed somewhat like butterflies except for the monotypic subfamily Albardiinae with short antennae that exists in Brazil that we have this subfamily ,also in Iran. The Ascalaphinae is the largest group and is unique in having the eyes divided by a transverse sulcus. This subfamily contains the day-flying and colorful *Libelloides* Schäffer of Europe also in Iran. The females of the most common New World genus of this subfamily, *Ululodes* Hagen, lay sterile eggs (repagula) coated with ant repellent material at least on the basal side of a string of eggs for protection. The third subfamily, Haplogleniinae, is worldwide. The males of some species of this subfamily (i.e., *Haploglenius*) have an apparent startle display in which a hinged flap covering the pronotum is suddenly lifted to expose a contrasting cream or white patch. The taxonomy of this family is difficult and the only worldwide treatment is by Van der Weele (1908), but much general information is found in Tjeder (1992).

The Nemopteridae are among the most distinctive looking of the Neuroptera with the hind-wings often extremely narrowed. The larvae have strongly curved mandibles but lack teeth. The Crocinae have the hind-wing threadlike whereas the Nemopterinae have the hindwing broadened distally. The head is often greatly prolonged ventrally similar to the Mecoptera and is a modification for feeding in flowers. The family is found in most continents except in North America. Most species are nocturnal but some are diurnal and very colorful, such as in the genus *Nemoptera* Latreille found in Europe. The Crocinae are mostly nocturnal with species usually very limited in distribution and are often in xeric areas. They flutter around at night and are attracted to white flowers. The crocine larva often has the prothorax greatly lengthened and are among the only Neuroptera to live peacefully together in groups of 30 or more, often in sand and small rocks under rock overhangs. These alert larvae have been seen to escape predators (and a shovel) en masse like a herd. The larvae of Nemopterinae appear more diverse and usually burrow into the sand head first in contrast to the antlions. Some genera (i.e., *Stenorrhachus* McLachlan) have larvae that live relatively deep under the sand and lack ocelli. In that genus, the females are wingless. *Palmipenna* Tjeder contains day-flying species in which the hind-wing is greatly broadened, evidently reducing attacks by robber flies (Stange, 2004).

Chapter 2:

Literature Review

2-1- Family Chrysopidae

McLachlan (1875) and Navas (1914) were the first entomologist to publish a list of Neuroptera of the Middle East. Many years later, Holzel (1966) published records of eleven species of Chrysopidae for the fauna of Iran. Holzel (1967) published a list of the Chrysopidae of Iran, in which he described the morphological characters of each species, gave identification keys, and recorded data on collecting dates and localities. This list already comprises 23 species. Some years later the same author described two new chrysopid species, i.e. *Anisochrysa mira* and *Suarius ressli*. The material on which these discribtions were based was collected by F. Ressl in 1970 and by E. and A. Vartian in 1971.In 1982, Holzel described the new chrysopid *Suarius laristanus*, which was collected by F. Ressl in 1970 in southern Iran. Aspöke et al. (1980) were other major neuropterist who worked on the Chrysopidae fauna of Iran. In their book Die Neuropteren Europas, they mentioned four species of *Anisochrysa*, six species of C*hrysopa*, one species of *Chrysoperla*, and one species of Suarius as forming part of the chrysopid fauna of Iran. Holzel was undoubtedly the first European neuropterist to study of Iranian Chrysopidae fauna in detail, but he himself never visited Iran and the specimens he studied were collected mainly by E. & A. Vartian, an Austrian-Armenian couple visiting Iran as tourists and amateur insect collectors.

Farahbakhsh (1961) list of the major agricultural pest of Iran, an important paper in which he was the first Iranian entomologist to mention a neuropterid from this country, namely *Chrysopa vulgaris*. This was the only species of Chrysopidae to be present in crop fields in association with aphid in Iran. Subsequently, Askri (1968) reported *Chrysopa perla* and C. *vulgaris* as two species of Chrysopidae present in aphid colonies in Bajgah, province of Shiraz. Some years later, other Iranian researchers reported *C. vulgaris* as being only chrysopid species occurring among colonies, such as aphids, psyllids, leafhoppers, mites and etc.

Habibi (1977) studied the ecology Alfa alfa Weevil (*Hypera postica*) and collected many specimens of *Chrysopa vulgaris* in the plantations of Alfa alfa in Kamal abad near Karaj. Ale-mansoor & Ahmadi (1993) collected and identified two neuropterid species as *Malada flavifrons* and *Chrysoperla carnea* in fars province. In 1987 Heydari recorded five species of Chrysopidae as new for the fauna of Iran. These species were *Suarius mongolica*, *S. gobiensis, S. nanus*, *Chrysopa dubitans*, and *Chrysopa septempunctata* (Heydari, 1987). Eight years later, the same author published a list of 19 species of Iranian Chrysopidae, amongst which *Anisochrysa genei*, *Chrysopa mutata*, and *C. walkeri* were reported for the first time for the fauna of Iran (Heydari, 1995). Heydari (1993) also reported *Italochrysa italica* as being present in scale colonies in Tonkabon, northern Iran. In 1996 Heydari reared Chrysopa iranica under laboratory conditions and also reported seven species of Chrysopidae from different parts of Iran, amongst which *Italochrysa italica* was a new record for the Iranian chrysopid fauna. In his book Rajabi (1979) mentioned *Chrysopa carnea*, *C. septempunctata*, *C. perla* , *C. ventralis* and *C. flavifrons* as predators of aphids in orchards throughout the country. He also recorded *C. perla* as secreting repugnant odour when irritated. Mostaan (1993) indicated the larvae of *Chrysopa vulgaris* as predators of

red European mites from orchards in Orumiya. Daniali et al. (1995) studied the prevalent species in Gorgan and Gonbad regions in northern Iran, and reported *Chrysopa formosa* as the dominant species in these areas, forming 70% of the chrysopid population, with *C. carnea* forming 20% of the remaining population. Saeb & Farzaneh (1995a, b) reported *Chrysoperla carnea* to be one of the most important predators of the black olive scale insect, *saisettia oleae*, and have studied its populations dynamics in olive orchards in Gilan province, northern Iran. From 1991 to 2000 Mirmoayedi studied the neuroptera fauna of Iran, including all the families of this order. He studied the Chrysopidae of different regions of Kermanshah province, where he collected and determined six species of Chrysopidae: *Chrysoperla carnea*, *Chrysopa septempunctata*, *C. viridana*, *C.dubitans*, *Suarius nanus*, and *S.fedtschenkoi* (Mirmoayedi, 1993). Later he reported and identified three more previously unrecorded species from this province, namely *Malada derbendica*, *Suarius paghmana*, and *S.vartianae*(Mirmoayedi, 1995).Yassayie & Mirmoayedi (1998) collected and studied the fauna of Neuroptera in Golestan National Park in north-east Iran,and recorded seven species of Chrysopidae from that region, namely *Chrysopa dubitans* ,*Anisochrysa amseli*, *A. flavifrons*, *A. prasina*, *Suarius nanus*, *Chrysoperla carnea* and *Chrysopa viridana*. Mirmoayedi (1998a) published a check-list of Neuroptera of Iran, comprising 39 species. These species were collected and identified between 1991 to 1996 from different regions of Iran, such as the provinces of Tehran, Gilan, Hormozgan, markazi, Kermanshah, Khuzestan and Ilam. In this eleven species of Chrysopidae, namely *Chrysopa dubitans*, *C. septempunctata*, *C. viridana*, C. iranica, *Chrysoperla carnea*, *Malada derbendica*, *M. prasina*, *S.fedtschenkoi*, *Suarius nanus*, *Suarius paghmana*, and *S. vartianae*, were included(Mirmoayedi, 1998a). A year later he also published a list of seven species of Chrysopidae from Kermanshah and kurdestan provinces. *Italochrysa vartianorum* was recorded for the first time for these provinces(Mirmoayedi, 1999a). In the same year he studied the Neuroptera fauna of Shiraz and identified seven species form that city in Fars province(Mirmoayedi, 1999b). Mirmoayedi & kharazi reared *chrysoperla carnea* and *chrysopa septempunctata* under labortorary condition, using drone honey bee powder as the nutritional medium for larvae and adult lacewings for the first time in Iran(Mirmoayedi & Kharazi pakdel, 1993). Jafari nadoshan collected three species of Chrysopidae in pistachio orchards in Kerman. These species were reported as *chrysoperla carnea*, *Suarius nanus*, and *Italochrysa italica*(Jafari nadoshan et al. 2000). Bozsik et al. (2002) studied fauna of Chrysopidae in Belgium. They reported 18 species green lacewings from that country as: *Nothochrysa fulviceps*, *Notochrysa capitata*, *Hypochrysa elegans*, *Nineta flava*, *Nineta vittata*, *Nineta pallida*, *Chrysotropia ciliate*, *Chrysopa perla*, *Chrysopa dorsalis*, *Chrysopa abbreviata*, *Chrysopa formosa*, *Chrysopa phyllochroma*, *Chrysopa pallens*, *Dichochrysa flavifrons*, *Dichochrysa prasina, Dichochrysa ventralis*, *Chrysoperla carnea*, *Cunctochrysa albolineata* and one species, *Nineta pallida*, was new record for the Belgian fauna.

A survey of lacewings was undertaken in an agricultural zone of northern France. Adults were investigated in four cultures: strawberry, potato, witloof and kidney bean, and in apple orchards. Seven green lacewings species were identified, but the lacewing diversity is low. In all cases, the eurytopic generalist predator *Chrysoperla kolthoffi* was the dominant species. Adults flied from May (wintering generation) to autumn, showing a peak in July. The occurrence of preimaginal instars suggests three generations. Four brown lacewing species were recorded, among them *Micromus variegatus* was the most abundant. They flew mainly in July and August(Trouve et al. 2002). study carried out on specimens collected from the Turkish province Konya, in 2001. A comparison with the descriptions (Holzel 1965, 1973, 1984, 1999, Gepp 1974, Aspock et al. 1980; 2001, Sengonca 1980; 1981, Monserrat & Holzel 1987, Monserrat 1980, Aspock & Holzel 1996) was revealed

the existence of yet another species described as new. The terminology used by Aspock et al., 1980 for wing venation and genitalia was adopted. The new species recorded as *Nineta gevnensis* sp. n. of Chrysopidae family (Canbulat & Kiyak, 2003). A new species of Chrysopidae from Konya province, Turkey; *Dichochrysa hadimensis* sp. n. was described, illustrated and compared to closely related species(Canbulat & Kiyak, 2005).The Chrysopidae of Canada and Alaska, the subject of a study since 1980, including more than 6,000 adults representing 24 species in two subfamilies. *Chrysopa quadripunctata* Burmeister and *Chrysoperla rufilabris* (Burmeister) were reported for the first time from the Province of Manitoba, Canada; and, *Meleoma emuncta* (Fitch), for the first time from the provinces of Alberta and Saskatchewan, Canada. Nomenclatural changes include: *Mallada slossonae* Garland, 1996, as a new objective synonym of *Dichochrysa macleodi* (Adams and Garland, 1983; *Mallada*) syn. nov., and *Dichochrysa perfecta* (Banks, 1895), an emendation (Garland, J.A. & Kevan, D.K. 2007). Ari et al. (2007) studied on 558 specimens belonging to 23 species of 10 genera of Chrysopidae of the order Neuroptera. These specimens were collected from Ardahan, Igdir and Kars provinces between 2001 and 2003. Among the species, *Dichochrysa ventralis* Curtis, 1834 is a new record for the Turkish Neuroptera fauna. Quantitative surveys of the chrysopid fauna from southwestern Europe, namely the Iberianand Italian peninsulas, France south of 46_ N, and the west-Mediterranean Islands, were analysed. A total of 56 species of Chrysopidae were reported, of which three species were abundant. These, *Chrysoperla carnea* (Stephens, 1836) sensu lato, *Dichochrysa prasina* (Burmeister, 1839) and *D. flavifrons* (Brauer, 1850), comprised a large percentage of the specimens(Canard et al. 2007). Also, Tauber et al. (2008) described a new species, *Leucochrysa* (*Nodita*) *digitiformis*, from an agricultural area in the coastal region of southeastern Brazil. in accordance with the most recent key to some agriculturally-associated lacewings in Brazil (Freitas and Penny 2001), that species would have been identified as *Leucochrysa* (*Nodita*) *clepsydra* Banks, which was described from the Andean region of Colombia (1,000–1,340 m). However, a comparison of our Brazilian specimens with Banks's syntypes of *L.* (*N.*) *clepsydra* showed that Freitas and Penny's redescription of *L.* (*N.*) *clepsydra* differs markedly from Banks's types in body size, wing shape, and male genitalia. To facilitate reliable identification of natural enemies in South American agroecosystems, we redescribe *L.* (*N.*) *clepsydra* (male and female) from the type specimens, describe a similar species from Brazil, and modify the existing key(Tauber et al. 2008).

2-2- Family Hemerobiidae

Mirmoayedi is the major entomologist who focused on study of Neuroptera fauna of Iran. He recorded six hemerobiid species from different regions of Iran. These species were *Hemerobius zernyi*(Esben Petersen), *Sympherobius pygmeus*(Rambur), *wesmaelius navasi(* Andreu), *W. saudiarabicus*(Holzel), *Hemerobius humulinus* L., *Micromus variegatus*(Fabricius). The species, *W. saudiarabicus*(Holzel) and *Micromus variegatus*(Fabricius), were recorded for the first time from Iran (Mirmoayedi, 1998). The family Hemerobiidae is one of the most speciose taxa of Palaearctic Neuroptera. Its fauna in the southern regions of the continental part of the Russian Far East (Primorskii Krai, southern Khararovskii Krai and southern Amurskaya Oblast) is considered well known. Ten species of the genus *Hemerobius* Linnaeus are known to occur in this region: *H. atrifrons* McLachlan, *H. exoterus* Navas, *H. humulinus* Linnaeus, *H. japonicus* Nakahara, *H. marginatus* Stephens, *H. simulans* Walker, *H. stigma* Stephens, *H. striatus* Nakahara, *H. subfalcatus* Nakahara and *H. tristriatus* Kuwayama(Makarkin et al. 2007). The family Hemerobiidae is today one of the most widely distributed groups of Neuroptera, with some 550 extant species described. They have been found as far back as the Jurassic, and are

known to occur in all major Tertiary localities. *Sympherobius completus* sp. n. from the Eocene Baltic amber was described. Its venation was probably the most generalized in the genus. The systematic position of the species, as well as hemerobiid wing venational terminology were discussed (Makarkin, V. N. and Wedmann, S. 2009). A new flightless hemerobiid species, *Nusalala brachyptera*, collected at high elevation in Costa Rica, was described and illustrated, and a variety of data relevant to the evolution of flightlessness in the family Hemerobiidae were reviewed. Flightlessness due to brachyptery has evolved independently in at least five monophyletic [= holophyletic] lineages of the family Hemerobiidae (brown lacewings). Volant hemerobiids are primarily foliage foraging arboreal predators [presumed ancestral condition], while flightless species are predominantly associated with terricolous-type microhabitats (e.g. ground-litter, epiphytic mosses) [presumed derived condition]. These differences suggest a significant habitat shift for flightless hemerobiid species, and that the parallel evolution of flightlessness and brachyptery in hemerobiids are shared responses to the conditions of a terricolous existence. The restriction of most flightless hemerobiid species to insular and/or montane/alpine land areas may be related to the typically depauperate nature of the faunas of such areas. This faunal characteristic may facilitate transitions from arboreality to terricolousness by presenting ancestrally arboreal predators such as hemerobiids with novel ecological opportunities in terricolous microhabitats (Oswald, 2007).

2-3- Family Ascalaphidae

Mirmoayedi (1998, 2002) reported the ascalaphid species, *Bubopsis hamatus* Klug, from Golestan National Park and Kermanshah province in Iran. The European owlflies, *Ascalaphus macaronius* (Scopoli, 1763), *A. libelluloides*, *Libelloides ottomanus* (Germar, 1817), *L. italicus* (Fabricius, 1781), *A. longicornis* (Linne, 1764) and *L. coccajus* (Denis et Schiffermuller, 1775) are rapidly- flying insects, were a part of European fauna (Kral, 2002; Letardi, A. & Migliaccio, E. 2002; Devetak et al. 2002). Ascalaphid fauna of Formosa (Taiwan) was presented and as a result of species revision, four new synonym names were established. *Glyptobasis brunnea* Esben- Petersen, 1913 syn n. was junior synonym of *Ascalohybris subjacens* (Walker, 1853), *Ascalohybris kolthoffi* (Navas, 1927) (original combination Hybris kolthoffi Navas, 1927) syn n. was junior synonym of Acheron trux (Walker, 1853), *Suhpalacsa longialata* Yang, 1992 syn n. was junior synonym of *Maezous umbrosa* (Esben- Petersen, 1913) comb. n. and *Suphalimitus lutemaculatus* Yang, 1992 syn n. was junior synonym of *Suphalimitus formosanus* Esben-Petersen, 1913. *Maezous formosana* (Okamoto, 1910) comb. n. was a new combination (Abraham, 2008). *Suhpalacsa iriomotensis* sp. nov. (Neuroptera: Ascalaphidae: Ascalaphinae), was described from Iriomotejima Is., Japan. This new species can be easily distinguished from other species of the genus by the unique ventrolateral prominences of the male ectoproct. This was the first record of the genus *Suhpalacsa* from Japan (Sekimoto, 2007). In studies the *Ptyngidricerus* Van der Weele, 1908 genus was revised and in these the studies 2 new genera and 4 new species were described. The new genera was reported as *Omanoidricerus* from Iran (Bandarabas, Chabahar, Baluchestan), United Arab Emirates (Manama, Ajman) and Oman(Ghawr and Wadi Sahtan) and *Iranoidricerus* from Nahavand and Lorestan in Iran. The following species belonging to *Ptyngidricerus* genus: *Ptyngidricerus albardanus albardanus*(McLachlan, 1891), *Ptyngidricerus albardanus pterostimatus* Alexandrov Martynov, 1926, *Ptyngidricerus pseudoalbardanus* sp. n, *Ptyngidricerus perspolisensis* sp. n. and *Ptyngidricerus sendanensis* sp. n. from Iran and *Ptyngidricerus pakistanensis* sp. n. form Pakistan. The recent four species were recorded for the first time from Palaearctic Region (Abraham, L & Meszaros, Z. 2002). The total number of species of Ascalaphidae recorded till now from Iran was 9

(Mirmoayedi, 2008). Satar, A & Özbay, C. (2002) described *Bubopsis zarudnyi* Alexandrov-Martynova, 1926 from Diyarbakır province, in the South-East of Turkey. The species has been recorded from Iran and Oman. This species was new for the Turkish fauna of Ascalaphidae. In continuing earlier research on female internal genitalia of Neuroptera, further examinations were carried out on some species of the family Ascalaphidae. In the family Ascalaphidae, four taxa, *Ascalaphus sinister* Walker, 1853, *Bubopsis andromache firyuzae* Sziraki, 2000 (Ascalaphinae), *Idricerus sogdianus* McLachlan, 1875 and *Protidricerus elwesi* (McLachlan, 1875) (Haplogleniinae) were investigated. In female internal genitalia of these species no distinctive features were found for separation of the two ascalaphid subfamilies (Sziraki, 2002).

2-4- Family Coniopterygidae

The dustywings, Coniopterygidae, are a family of Pterygota (winged insects) of the net-winged insect order (Neuroptera). About 490 living species are known (Engel & Grimaldi, 2007). Mirmoayedi (1995c) recorded two species, *Conioteryx deserta* and *Helicoconis kurdica*, from Hormozgan province in Iran. The species, *Conioteryx deserta*, was reported for the first time in Iran. Also, Mirmoayedi(1998) described *Coniopteryx (Xeroconiopteryx) loipetsederi* H. Aspock, 1963 and *Hemisemidalis pallida* (Withycombe, 1924) from Golestan National Park in Iran. The species, C (*Xeroconiopteryx*) *loipetsederi* was new for the Iranian fauna. To extend the knowledge of the neuropteran fauna of Iran, collections were performed in the provinces of Tehran, Guilan, Hormozgan, Markazi, Kermanshah, Khuzestan and Ilam. In this survey, species belonging to the family Coniopterygidae were as: *Aleuropteryx ressli* Rausch, Aspock & Ohm(from Kermanshah and Ridjab), *Coniopteryx (Metaconiopteryx) lentiae* Aspock & Aspock(from Ridjab), *C. (Xeroconiopteryx) deserta* Meinander(from Ridjab), *C.(X) unicef* Monserrat(from Gazir in Hormozgan), *C.(X) venustula* Rausch & Aspock(from Gazir in Hormozgan), *Helicoconis pseudolutea* Ohm(from Bandar khamir in Hormozgan and Ridjab in Kermansha), *Hemisemidalis kasyi* (Aspock & Aspock)(from Kermanshah and Ridjab), *Nimboa vartianorum* Aspock & Aspock(from Ridjab) and *Semidalis aleyrodiformis* (Stephens)(from Minab in Hormozgan)(Mirmoayedi, 1998). In 1999, Mirmoayedi described two new species as: *Coniopteryx manka* and *Coniopteryx farsi* Mirmoayedi, 1999 from Shiraz province in Iran. The earlier species was reported new for Iranian fauna and the recent species was recorded for the first time in the world (Mirmoayedi, 1999a). In the same year, the same author reported *H. kasyi* and *H. pallida* from Kurdistan province in Iran (Mirmoayedi, 1999b). The species *Nimboa asadeva* Rausch & Aspock, 1978, *C. (Holoconiopteryx) drammonti* Rousset,1964, and *C. (X) furcata* Meinander,1998 were reported from Kurdistan and Hormozgan, Mashhad, and hamedan provinces, respectively. The late species was new for Iran (Mirmoayedi, 2002). Overall, there are about 25 described species of the family Coniopterygidae in Iran (Mirmoayedi, 2002). Liu et al. (2004) were reported Six Chinese species of the genus *Heteroconis* Enderlein, 1905. Among them, four species were described as new to science: *Heteroconis electrina*, new species, *H. hainanica*, new species, *H. tricornis*, new species, and *H. unicornis*, new species (Liu et al. 2004). Abraham (1998) was described 13 species of family coniopterygidae from in protected Duna-Drava National Park in southwestern border of Hungarian. The material was determined in this family based on the internal and external characteristics. Among described species, the species, *Helococonis lutea*, was new for this area. Meinander (1990) stated that five species of *Parasemidalis* genus were known from Europe, Mongolia, U.S.A., and Mexico. The species, *Parasemidalis fuscipennis* (Reuter, 1894) was reported for the first time in Turkey. This species was collected by a net in a coniferous forest (*Abies cilicica* subsp. *cilicica*) (Canbulat. 2007). New data on the

biology, distribution and sometimes morphology of 43 Palaearctic and Afro-tropical dusty wings species were given. Among those, *Helicoconis canariensis* n. sp. and *Coniopteryx canariensis* n. sp. from Canary Islands and *Semidalis pallidicornis* n. sp. from Uganda were described as new species (Monserrat, 2002). Two species of this family were collected from Iranian rice fields and surrounding grasslands as: *Coniopteryx* (*Holoconiopteryx*) *drammonti* Rousset, 1964 from Shahrekord in Chaharmahal & Bakhtiari province and *Hemisemidalis pallida* (Withycombe, 1924) from Shahrekord in Chaharmahal & Bakhtiari province and Gorgan in Golestan province(Ghahari, et al. 2010). *Coniopteryx (Xeroconiopteryx) furcata* and *C. (X.) israelensis*, and *C. (X.) hastata* (from Iran) were described as new species. *Nimboa vartianorum*, *Coniopteryx drammonti*, *C. lentiae*, *C. (X.) unicef* and *Hemisemidalis kasyi* were new for Iran(Meinander, 1998).

2-5- Family Myrmeleontidae

The Neuropteran fauna of Iran has been studied rather well and the total identified species of Iranian Neuroptera is 168. It is estimated that the Iranian ant-lion fauna comprises more than 100 species, while the world fauna of these insects is more than 2000. The most important researches on Iranian Neuroptera which was recently published were Mirmoayedi (1998, 2002), Yassayie and Mirmoayedi (1998) and Mirmoayedi et al. (1999). Mirmoayedi (1995c) reported the species, *Cueta minervae*, of this family as a new for ant-lion fauna from Hormozgan provice in Iran. From 1991 to 1995, specimens belonging to the species of myrmeleontidae were captured, by the use of light trap in the Kermanshah province in Iran. Samples of Neuropterans were identified by use of keys provided by Aspock 1980 and Holzel 1988. The names of species were as: the species, *Delfimeus mogani*, and the species, *Echtomyrmex platypterus*. these two species were the first record for the fauna of Iran (Mirmoayedi, 1996). Mirmoayadi et al. (1998) collected and studied the fauna of Neuroptera in Kermanshah province and Golestan National Park in north-east Iran, and reported six species of Myrmeleontidae from that regions as *Palpares libelluloides* (Linnaeus, 1764), *Palpares solidus* Gerstaecker, 1893, *Aspoeckiana uralensis curdica* Holzel, 1972, *Euroleon parvus* Holzel, 1972, *Neroleon (Ganussa) lukhtanovi* Krivokhatsky, 1996, *Neroleon (Neroleon) jucundus* Navas, 1921. The recent three species were new for the Iranian fauna. In the same year, Mirmoaydi published another list of antlion fauna of Iran, which comprised; *Creoleon elegans* Holzel, *C. remanei* Holzel, *Cueta minervae* Holzel, *Delfimeus morgani* (Navas), *Echthromyrmex platypterus* (McLachlan), *Myrmecaelurus trigramus* (pallas), *Neuroleon tenellus* (Klug) and *Palpares solidus* Gerstaecker (Mirmoayedi, 1998). The species, *Acanthoclisis occitania* recorded for the first time from Kermanshah province (Mirmoayedi, 1999). and, *Cueta modesta*, recorded from Fars province (Mirmoayedi, 1999a). In another article, published in 2000, Mirmoayedi recorded 6 species from different provinces in Iran that among them 4 species were new for Iranian fauna as: *Mesonemurus vartianorum*, *Creoleon desertus*, *C. persicus*, *Myrmaecaelurus parvulus*. Mirmoayadi (2007) recorded new species, *Cueta clara* Holzel, 1980 from Fars province and new species, *Gymnocnemia variegata* Schneider, 1845 from Hamadan province in Iran. Ghahari et al. (2010) recorded *Myrmeleon hyalinus* Olivier 1811 and *Palpares solidus* Gerstaecker, 1894 in Iranian rice fields from Isfahan, Chaharmahal & Bakhtiari, East Azerbaijan provinces and Isfahan province, respectively. The Myrmeleontid genus *Pseudimares* Kimmins, 1933, described on the basis of one male and one female of an unknown species (both specimens found in one locality in the south of Iran and never recorded since then) was rediscovered in Morocco. The single specimens, a male, represent a new species, which was described as *Pseudimares Aphrodite* n. sp. The new species was as spectacular as *Pseudimares iris* (the Iranian

species), particularly due to the big eye spots on both wings and the unusually long legs (Aspock, H. & Aspock, U. 2009).

2-6- Family Mantispidae

There is a few species of Mantispidae family in Iranian fauna. The species were as: *Mantispa stryiaca* (Poda, 1761), *Mantispa aphavexelta* Aspock, U & H., 1994, *Mantispa scabricollis* McLachlan, 1875 (Mirmoayedi, 2002).

2-7- Family Nemopteridae

The Nemopteridae of Iran was studied by Alexandrov-Martynov (1930), Holzel (1975) and Mirmoayadi (2002). The total number of Nemopteridae from Iran, reported by these authors, is 16 species (Mirmoayadi, 2008). Mirmoayedi (1995, 1998) recorded the species, *Dielocroce elegans* (Alexandrov-Martynov), from Bandar khamir and Kermanshah in Iran. Also*, Olivierina extensa* (Olivier), from Kermanshah, *Dielocroce maxima* Holzel, 1975, from Hamadan and *Dielocroce vartianae* Holzel, 1975, from Sanandadj were described (Mirmoayedi,1998; 2002). *Dielocroce ephemera* (Gerstaecker, 1894) which was described from Mardin province (Turkey) in 1894 and has not been found since then, was re-discovered in Batman province in 2002. The description includes illustrations of both male and female genitalia and a discussion of the taxonomic status of the species (Satar et al. 2004).

Chapter 3: Materials and Methods

3- Materials and Methods

3-1. Collecting sites

During May to September 2008–2009 Neuropterans were collected from different regions in Hamadan province in Iran by different methods. Hamadan province is located in the west part of Iran and lies in a temperate mountainous region to the east of Zagros mountain chains. The vast plains of the north and northeast of the province are influenced by strong winds, which last throughout the year. This province is bounded on the north by Zanjan and Qazvin provinces, on the south by Lorestan province, on the east by Markazi province, and on the west by Kermanshah and Kurdistan provinces. Hamadan is one of the mountainous provinces of Iran. The highest point in this province is the Alvand peak, 3574 meters high. The coordinates of this area are 47°.34 and 49°.36 E /33°.59 and 35°.49N. Most Neuroptera specimens were attracted to light traps, but some were taken in Malaise trap equipped with an ultraviolet florescent tube light and also was collected using a sweep net. Neuroptera were Collected from 20 different localities in Hamadan province as follows Shahanjarin (1), Shvand (2), Gavanloo (3), Damagh (4), Babanazar (5) , Gol tappeh(6), Qale joogh (7), Lalejin (8), heydareh (9), Vahnan (10), Ganjnameh (11), Maryanaj (12), daremorad beyk (13), Qaleh astijan (14), Serkan (15) Hoseyn abad(16), lashkardar protected area (17), dehful (18), Sarab Gian (19), and Shahrab (20). These numbered localities are should be seen in Fig 3-1.

Fig 3-1. Collecting sites in Hamadan province, from where Neuropteran specimens was collected