FAUNISTIC NOTES ON FORMICIDAE (INSECTA: HYMENOPTERA) OF RICE FIELDS AND SURROUNDING GRASSLANDS IN NORTHERN IRAN

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ABSTRACT: The fauna of ants (Hymenoptera: Formicidae) was studied in rice fields of Northern Iran, Mazandaran province through 2000 until 2006. In a total of 39 species from 17 genera and 3 subfamilies were identified. Of these 34 species and subspecies are new records for the Iranian fauna.

KEY WORDS: Formicidae, Fauna, Rice field, Northern Iran

Rice field is one of the rare agroecosystems which included both arid and aquatic ecosystems; in this case the fauna of insects is more diverse than the other agroecosystems (Bambaradeniya and Amerasinghe, 2003). There are several pests in the rice fields that in absence of management programs damage the crop severely (Heinrichs, 1994). Besides, there are several natural enemies (especially predators and parasitoids) in the rice fields of the world that decrease the population density of the pests significantly (Mohyuddin, 1990). One of these powerful predators is ants (Hymenoptera: Formicidae) (Bonhof et al., 1997). Ants, with an estimated world population of 10^{15} adults, are most abundant in most climates especially the tropics where in rain forests they may represent between one third and half of the insect biomass (Fittkau and Klinge, 1973). In view of their abundance, their stability as populations, and their feeding habits, ants have a major influence in many habitats. As predators of pests, they may be useful in pest management, but such positive attributes must be weighed against possible disadvantages (Way and Khoo, 1992).

Important attributes of useful ant species are listed by Risch & Caroll (1982) as follows: *a.* they are very responsive to prey density; *b.* they can remain abundant even when prey is scarce because they can cannibalize their brood and, most importantly, use honey dew-producing Homoptera as a stable source of energy; *c.* they can store food and hence continue to capture prey even if it is not immediately needed; *d.* besides killing pests, they can deter many others including some too large to be successfully captured; *e.* they can be managed to enhance their abundance, distribution, and contacts with prey. Other useful criteria for ants as biological control agents include broad habitat range and choice of species that are unlikely to be out-competed by other ants (Majer, 1986). Finnegan (1974) lists desirable characteristics of certain *Formica* spp., some of which are relevant to other ants, including the ability to hunt at different levels and to concentrate increasingly on a particular prey species as its population increases. Polygyny is a useful attribute because colony fragments can easily be transferred to establish new colonies (Way and Khoo, 1992). All the literatures on beneficial and potentially beneficial ants especially the ants' role in biological control and pest management were reviewed by Way and Khoo (1992).

Iran is a large country incorporating various geographical regions and climates; therefore it would be expected that there are a diverse fauna of ants in this region. But the fauna of this important and large family was studied very poorly in Iran (Modarres Awal, 1997; Ghasemi et al., 2000; Alipanah and Dejakam, 2000; Alipanah et al., 2000; Tahmasebi et al., 2000; Tahmasebi and Alipanah, 2002; Alipanah, 2004; Askarzadeh et al., 2004). The goal of this paper which is a part of large project as "Iranian Formicidae" is introducing the ants' fauna in different Iranian agroecosystems.

METHODS

Totally 20 plastic pitfall traps, 8.5×10 cm (diameter × depth), were installed at 10 m intervals in different rice fields and were part-filled with ethanol 75%. The traps were emptied weekly for three crop seasons and the fallen beetles were collected and identified. In addition to the pit fall traps, sweepings were conducted randomly in different rice fields of Northern Iran. Also several samplings were conducted after harvesting the crops in autumns and winters by the mentioned methods.

SPECIES LIST

Totally 39 species of the 17 genera (*Camponotus*, *Cataglyphis*, *Formica*, *Lasius*, *Lepisiota*, *Plagiolepis*, *Polyrhachis*, *Aphaenogaster*, *Cardiocondyla*, *Crematogaster*, *Messor*, *Monomorium*, *Pheidole*, *Solenopsis*, *Tetramorium*, *Linepithema*, *Tapinoma*) and three subfamilies (Formicinae, Myrmicinae and Dolichoderinae) were collected and identified from Mazandaran Province. Almost the materials were collected by the senior author and are deposited in the collection of the second author.

Family Formicidae
Subfamily Formicinae

Camponotus oasium Forel, 1890
Ghaemshahr (Ahangarkola), November 2001; Joibar (Divkola); August 2002.
*__*Camponotus xerxes*__ Forel, 1904
Amol, June 2005; Ghaemshahr (Sarokola), April 2006.
*__*Cataglyphis auratus*__ Menozzi, 1992
Amol, September 2005.
*__*Cataglyphis albicans*__ var. ***auratus*** Menozzi, 1932
Amol, August 2005; Babol (Amirkola), July 2006.
*__*Cataglyphis lividus*__ Andre, 1881
Savadkooh (Zirab), June 2003.
*__*Cataglyphis nodus*__ var. ***drusa*** Santschi, 1929
Amol, April 2005; Fereydonkenar, November 2005.
*__*Cataglyphis semitonsus*__ Santschi, 1929
Savadkooh (Polsephid), July 2000.
*__*Formica glauca*__ Ruzsky, 1896
Amol, Aug. 2005; Babol (Bandpey), May 2006.

**Lasius alienus* Foerster, 1850
Galoogah, August 2002.
**Lasius neglectus* Van Loon, Boomsma & Andrasfaldvy, 1990
Amol, November 2005.
Lasius turcicus Santschi, 1921
Savadkooh, July 2003; Ghaemshahr, June 2005.
Lepisiota frauenfeldi* subsp. ***Karavievi* Ugamsky, 1929
Amol, April 2006.
**Lepisiota karavievi* Pisarski, 1967
Amol, June 2005.
**Plagiolepis maura* Santschi, 1920
Amol, November 2004; Ghaemshahr, October 2005.
**Polyrhachis lacteipennis* Smith, 1858
Amol, September 2005.

Subfamily Myrmicinae

**Aphaenogaster obsidiana* Mayr, 1861
Babol, June 2002.
**Cardiocondyla stambouloffi* Forel, 1892
Amol and Sari; September 2003.
**Crematogaster antaris* Forel, 1849
Joibar, July 2000.
**Crematogaster subdentata* Mayr, 1877
Neka, August 2004; Sari, August 2005.
**Crematogaster warburgi* Menozzi, 1933
Behshahr, June 2001; Sari, April 2003.
**Messor alexandri* Thome & Thome, 1981
Amol, September 2006.
**Messor darianus* Pisarski, 1967
Amol and Ghaemshahr, October 2005.
**Messor denticulatus* Santschi, 1927
Savadkooh, July 2003.
**Messor medioruber* Santschi, 1910
Amol, June 2006.
Messor caducus Victor, 1839
Sari and Neka, June 2002.
**Messor sultanus* Santschi, 1917
Babol, August 2003.
**Monomorium areniphilum* Santschi, 1911
Ghaemshahr and Joibar, September 2004.
**Monomorium pharaonis* Linnaeus, 1758
Savadkooh, July 2003.
**Monomorium venustum* Smith, 1858
Babol, Aug. 2003.
**Pheidole megacephala* Fabricius, 1793
Amol, August 2005.
Pheidole pallidula Nylander, 1849
Savadkooh (Shirgah), October 2000.
**Solenopsis wolfi* Emery, 1915
Ramsar, July 2003.
**Tetramorium caespitum* Linnaeus, 1758
Savadkooh (Shirgah), October 2000.
Tetramorium punctatum Santschi, 1927
Noor, July 2005.
**Tetramorium taurocaucasicum* Arnoldi, 1977
Amol, June 2005, Ghaemshahr, April 2006.

Subfamily Dolichoderinae

****Linepithema humile*** Meyr, 1868
Nooshahr and Noor, September 2005.
****Tapinoma festae*** Emery, 1925
Fereydonkenar and Chalus, November 2001.
****Tapinoma karavievi*** Emery, 1925
Chalus and Tonekabon, June 2004.
Tapinoma simrothi subsp. ***Karavievi*** Emery, 1925
Behshahr and Neka, August 2001.

DISCUSSION

The results of this survey indicated that the subfamily Myrmicinae is more diverse than the two other subfamilies with 20 species. Majer (1986) classified ants into status categories of dominant; subdominant, which can attain dominant status in the absence of dominant ants; and nondominant, which live within or between the territories of dominant ants. Dominant ants include species that are most conspicuously useful for biological control.

Good evidence shows that ants prey on the egg of pest species in many different countries and habitats. For example, in Sri Lanka virtually 100% of eggs of *Opisina arenosella* were removed within 24 h by *Monomorium floricola*. *Solenopsis invicta* was part of a complex killing of over 70% of eggs of *Heliothis virescens* in 24 h on cotton where ratios of predators to prey ranging from 2: 1 to 200: 1 seem able to prevent significant pest damage. On sugar cane, over 90% of eggs and small larvae of *Castnia licus* and 92% of eggs of *Eldana saccharina* were killed by ants. *Pheidole* spp. are major predators in complexes that can kill over 95% of eggs of *Alabama argillacea* and some 80% of *Diabrotica* spp. eggs in the soil (Way & Khoo, 1992). Therefore, ants alone or as an important part of predator complex can cause very large mortalities of eggs and so can contribute importantly to natural control (Jaffe et al., 1990). More specific case studies are needed to assess the importance of such mortality, especially because increased egg mortality can sometimes be compensated for by decreased larval mortality (van Hamburg & Hassell, 1984).

The stability, social organization, and foraging behavior of some predatory ants enable them to react quickly to increasing prey density, and also make them uniquely able to protect crops from low-density pests. Such qualities require dependence on honeydew-producing Homoptera that may sometimes be made harmful by ant attendance. Cost-benefit judgments are therefore needed when such ants are to be used.

Predacious ants also affect other natural enemies, but less than might be expected, and may indeed benefit some. Ants tend to overlap the food niches of other predators and may force them into one competitive system. Whether overall biological control is benefited by such interactions is unknown. Work on the role of ants as part of overall natural-enemy complexes is needed. In addition, inadequate attention has been given to understanding ant-prey interactions. Research such as that carried out in some natural habitats needs to be undertaken in agroecosystems.

Behavioral attributes that enable one species, for example, a very small and apparently inoffensive species, to dominate over larger more aggressive species are not understood and need detailed investigation. Studies of this type should provide valuable clues to manipulating systems in favor of some beneficial species.

Biological-control attributes of many relatively inconspicuous nondominant ants have been inadequately studied. Some species may he valuable in their own right, but many also make a significant contribution to overall natural mortality, which needs to be understood much better than it is at present.

The results are promising from some ecological approaches to manipulating beneficial ants by cultural practices and habitat modification. More emphasis is needed on practical application, especially since some ants have sharply contrasting pest and beneficial attributes. Since eradication is impossible, the emphasis should be on enhancing their role in habitats where they are beneficial while controlling them elsewhere. Such approaches need not be incompatible.

Although the introduction of exotic predatory ants for biological control is potentially hazardous, it should not be discounted. In this context, work is needed on some accidentally introduced species that have important biological-control attributes.

Finally, in some circumstances, ants are uniquely useful, as when they are the only alternative to intensive insecticide treatment, or where alternative practices are uneconomic or impracticable.

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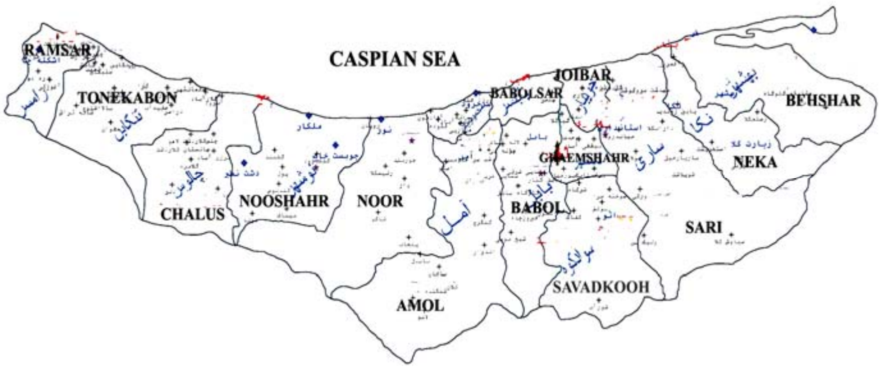

Fig. 1. The map of Mazandaran province, Northern Iran.