ÇOMÜ Zir. Fak. Derg. (COMU J. Agric. Fac.)
2015: 3 (1): 9–13

Trophic Relationship, Annual Cycle, Seasonal Diapause and Pest Potentiality of Alfalfa Weevil, *Hypera postica* Gyll. (Hyperinae: Curculionidae: Coleoptera)

Neelima Talwar[1*]

[1]Post Graduate Government College for Girls, Sector–42, Chandigarh, India.
[*]Corresponding author: neelimatalwar@yahoo.com

Recieved: 22.01.2015 Accepted: 25.02.2015

Öz

Yonca Hortumlu Böceği (*Hypera postica* Gyll.) (Hyperinae: Curculionidae: Coleoptera)'nin Tropik İlişkisi, Yıllık Döngüsü, Mevsimsel Uykusu ve Zarar Olasılığı

Yonca hortumlu böceği (*Hypera postica*)'nin biyolojisi, Hindistan'ın Chandigarh Bölgesi'nde araştırılmış ve bu tür üzerindeki bulgular Hindistan ve dünyanın farklı bölgelerinden gelen diğer raporlar ile karşılaştırılmıştır. Bu hortumlu böceğin, *Fabacae* familyasına ait olan yem bitkilerinin *Medicago*, *Trifolium*, *Melilotus* ve *Vicia* gibi cinslerine saldırdığı, ama aynı zamanda farklı bölgelerde diğer gerçek ve geçici konukçu bitkilere de geçtiği görülmüştür. Hortumlu böceğin larvaları ektofaj olduğu için, retikulat bir koza içinde pupa haline gelmeden önce bitkilerin uç kısımlarındaki yapraklar üzerinde beslenmektedir. Hortumlu böceğin yeni çıkan genç bireyleri, soğuk bölgelerde kışlamaları, sıcak bölgelerde ise yaz uykusu ile karakterize edilmekte, hortumlu böcek yılda 1–3 nesil verebilmektedir. Hortumlu böcek, dünyanın farklı yerlerinde mera bitkilerinin zararlısı olarak küçükten büyüğe doğru değişken bir zarar statüsüne sahiptir.
Anahtar Kelimeler: *Hypera postica*, Konukçu bitkiler, Yaşam süresi.

Abstract

Main feature of the biology of *Hypera postica* has been studied in Chandigarh area and the findings have been compared with other reports on this species from India and different parts of the globe. It seems that the beetle attacks the fodder plants of genera *Medicago, Trifolium, Melilotus* and *Vicia*, belonging to family Fabacae but also shifts to other actual and transitory hosts in different regions. The larvae are ectophagous feeding on terminal leaves before pupating in a reticulate cocoon. The young beetle is characterized by summer diapause along with overwintering in colder regions. It passes through one to three generations in the course of the year. It has a variable status as pest of pasture crops as it causes minor to major damage in different parts of the world.
Keywords: *Hypera postica*, Host plants, Life cycle.

Introduction

Genus *Hypera* is quite a large genus with its inclusive species widely distributed in different regions. *Hypera postica* (Gyll.), is one of the most common and best known species. *Hypera* species are mostly associated with leguminous fodder plants primarily represented by Genera *Medicago, Trifolium, Melilotus* and *Vicia*. Some scattered biological notes (Melamed–Madjar, 1962; Kushwaha and Jain, 1963; Subba Rao et al., 1967; Miller and Guppy, 1972; Gurrea, 1981; Akbari–Noushad, 1995) have been published on this species in different regions. In order to have a general view on the biological characteristics of *Hypera postica*, an attempt has been made to compile the available data.

Materials and Methods

Observations made on the biology of *H. postica* in Chandigarh area were compared with the activities of this beetle in the other regions in order to understand the general behavior, annual cycle and diapause condition of the beetle. The adults were collected from the fields of *T. alexandrinum* during the winter months. The females laid eggs in tender stems of the host plant. These stems were separated and kept in petri dishes till the hatching of eggs. The fresh larvae were transferred to pots of host plants. The pots were examined at regular intervals to follow the development of larvae and their pupation. The emerging adults were provided curled leaves of the host plant as shelter. Field surveys were conducted for three consecutive years to ascertain their behavior during both active and diapausing periods.

Results and Discussion

Host plants

Studies carried out in India reveal that *H. postica* attacks the common fodder Plant, *Trifolium alexandrinum* in Chandigarh and surrounding areas (Pajni and Nanda, 1995). However it is a major pest of Lucerne in northwestern and western Himalayas and Gangetic and central plains of India (Kushwaha and Jain, 1963; Subba Rao et al., 1967; Singh et al., 2009). The beetle is also an active pest of alfalfa in Kargil (Ladakh) area (Rather and Kumar, 2011).

Outside India, alfalfa weevil mainly attacks different species of *Medicago* in a number of countries spread over Asia and Palearctic and Nearctic regions (Yakhontov, 1934; Miller and Guppy, 1972; Gurrea, 1981; Ohto, 1996; Summers, 1998; Goosey, 2009).At the same time it is also associated with *Trifolium* in USA, Iran, Israel and Egypt (Melamed–Madjar, 1962; Gonzalez et al., 1980; Ellsbury et al., 1992; Moradi–Vajargh et al., 2011).

In addition to these two major hosts i.e., *Trifolium alexandrinum* and *Medicago sativa*, which are the known fodder plants, the weevil also has been found infesting several other unrelated plants and trees (Lodos et al., 1978; Compobasso et al., 1999). Whether such hosts actually provide food for the larvae and the adults of *H. postica* or they are simply transitory hosts which the beetles infest occasionally cannot be stated with certainty. Moreover, in certain regions a different type of vetch is major host in comparison to otherwise common hosts i.e., *Trifolium* and *Medicago.* This is particularly true of Japan where the beetle is major pest of *Astragalus sincus* (a milk vetch) which is used as green manure for rice cultivation (Kanda et al., 2004).

It is interesting to note that adult beetles have to feed necessarily on the host plant before becoming capable of mating and reproduction. This is in line with observation of Pajni (1981) according to whom the field bruchids like *Bruchus pisorum* Linn. and *Bruchus lentis* Frol. resort to obligatory feeding on nectar and pollen of their respective host plants. The same is true for field species of some Curculionidae (Pajni and Nanda, 1992; Talwar and Pajni, 1995). As a matter of fact, the correlation between host feeding and reproduction appears to be a common feature in the field insect. They undergo a period of diapause before becoming active and start feeding before initiating mating followed by oviposition.

Annual cycle

The adult weevils enter a dormant phase of imaginal diapause or reproductive diapause. As the dormancy occurs during summer months it is usually referred to as aestivation. The aestivation period lasts from May to November (Pajni and Nanda, 1995, Singh et al., 2009).

During aestivation, the adults have been found taking shelter under barks of trees like *Eugenia jambolina, Ficus glomerata* and Eucalyptus (Pajni and Nanda, 1995). The diapausing beetles resume activity during October/ November when the climate becomes mild.

As already mentioned, the beetles feed on the leaves of *Trifolium alexandrinum* for a period of 10–15 days before the onset of mating. During copulation the pair remains engaged in male above the female position for an average of 3.63 hours. The oviposition starts within about 11 hours of copulation. Before oviposition, the female cuts a small puncture on the stem of *T. alexandrinum* and then lays eggs one by one. The number of eggs laid at different sites is variable with a maximum of 45 eggs (Subba Rao et al., 1967; Pajni and Nanda, 1995). It has also been noticed that during first three days of oviposition, the female prefers to lay eggs on the surface of the stem or on fresh leaves. The resulting larvae are ectophagous i.e., feed externally on leaves. On the other hand, the larvae hatching within the hollow stem climb upward to reach and feed on terminal inflorescence. There are 4 larval stages and the mature larvae are rather good feeders but do not cause enough damage to acquire the status of a pest. The attack on the plants is however visible by feathering of leaves with only midribs intact. The mature larvae prepare reticulate cocoons within which the pupa remains for a period of 7–10 days. The freshly emerged adults feed for 1 or 2 months during March &April before shifting to aestivating sites. The aestivating adults appear in the field of barseem during November end and start ovipositing to complete the annual cycle.

Summer diapause or aestivation appears to be a common feature in *H. postica* irrespective of the region they come from. However in cold regions, the adults also resort to overwintering in addition to summer aestivation, as has been reported in populations from Israel (Melamed–Madjar, 1962), Spain (Gurrea, 1981), Iran (Akbari–Noushad, 1995) and USA (Salisbury, 2004). In fact the beetle

occurs in two strains in USA and Iran, a summer strain and a winter strain, with the former remaining active in summer and latter becoming so in cold months. Moreover, it has also been observed that the beetles also overwinter in egg and larval stages in some regions (Akbari–Noushad, 1995; Goosey, 2009), whereas in most other cases only adults overwinter.

The univoltanistic behaviour of *Hypera postica*, as recorded in Chandigarh areas, is also supported by observations of Subba Rao et al., (1967) in Udaipur. Surprisingly, Kushwaha and Jain (1963) found the beetle to pass through three generations in certain parts of India. But, the pest passes one generation in many countries including USSR, Germany, Canada, Iran and Japan, two generations in Israel and 1 to 3 generations in different climatic zones of USA. (Yakhontov, 1934; Kaufman, 1939; Michelbacher, 1943; Hamlin et al., 1949; Melamad–Madjar, 1962; Miller and Guppy, 1972; Akbari–Noushad 1995; Ohto, 1996).

Damage

Damage to the host plants is caused by the larvae and the adults which consume terminal leaves, buds and growing tips as well as foliage on the lower parts of the stem. The adults also feed on margins of leaves.

The beetle is a minor pest of *Trifolium* in Chandigarh, but assumes the status of a pest of alfalfa in most parts of the country (Nayar et al., 1992). Its infestation leads to lowering of yield by 10–20% (Pandey and Faruqi, 1990; Chandra and Pandey, 2011) except Kargil where the reduction in yield crop is much more (Rather and Kumar, 2011). The status of *H. postica* is quite variable in other countries where the beetle is known to attack several fodder and non–fodder plants. According to MetCalf and Luckman (1994), it is the most destructive pest of alfalfa in the world. The beetle is responsible for 60% damage mainly due to the larval feeding in Iran (Khanjani and Pourmirza, 2004) and reduces the yield of alfalfa in Saudi Arabia (Dabbour and Hammad, 1982; Abu–Thuraya, 1982). In Japan, the farmers use Chinese milk vetch (*Astragalus sincus*) as green manure in winter and its flowers provide a source of nectar in spring. Therefore the pest is not a pasture pest but a pest of paddy field agro ecosystem during non crop season (Okumura, 1991). The pest reduces the yield of Lucerne (1st Crop) by about 65% in Russia. The activities of the larvae and adults of *H. postica* thus cause good deal of damage to their major and minor hosts resulting in sufficient losses in the yield of these crops.

Conclusions

It follows from the above given account that *H. postica* primarily attacks *Trifolium alexandrinum* and *Medicago sativa* in India and several other regions. It is also a pest of pasture crop of the genera *Melilotus,* and *Vicia* in areas other than India. The beetle passes 1–3 generations in the course of the year resorting to summer aestivation and occasionally overwintering in winter months subjected to geographical variations.

Since the beetle is a known pest of fodder plants, their population cannot be reduced through application of pesticides due to contamination of food. The only other alternatives are biological control and cultural practices**.**

Acknowledgements: The author is extremely thankful to Prof. H.R. Pajni for his useful suggestions in preparing this manuscript. The access provided by Google to various research articles is greatly acknowledged.

References

Abu–Thuraya, N.H.P., 1982. General survey of agriculture pests in Saudi Arabia. Ministry of Agric. and water, Riyadh (In Arabic). pp: 240.

Akbari–Noushad, Sh. D., 1995. Biology of alfalfa weevil *Hypera postica* (Coleoptera: Curculionidae) in East Azerbaijan. Proceedings of 12th Iranian Plant Protection Congress 2–7 September, 1995 Karaj (Iran Islamic Republic). pp: 92.

Campobasso, G., Colonnelli, E., Knutson, L., Terragitti, G., Cristofaro, M., 1999. Wild plants and their associated insects in the Palearctic region, Primary Europe and Middle East. U.S. Department of Agric., Agricultural Research Service ARS–147, pp: 249.

Chandra, A., Pandey, K.C., 2011. Assessment of genetic variation in Lucerne (*Medicago sativa* L.) using protease inhibitor activities and RAPD markers. J. Environ. Biol. 32: 559–565.

Dabbour, A.I., Hammad, S.M., 1982. Insect and Animal pests and their control in the Kingdom of Saudi Arabia. Uni. Libraries, King Saud Univ., Riyadh (In Arabic).

Ellsbury, M.M., Pederson, G.A., Fair brother, T.E., 1992. Resistance to foliar feeding Hyperinae weevils (Col.: Curc) in cyanogenic white clover. J. Econom. Ento. 85 (6): 2467–2472.

Gonzalez, D., Etzel, L., Esmaili, M., El–Heneidy, A.H., Kaddou, I., 1980. Distribution of *Bathyplectes* curculionis and Bathyplectes anurus (Hym: *Ichneumonidae*) from Hypera (Col.: *Curculionidae*) on alfalfa in Egypt, Iraq, and Iran. Entomophaga. 25 (2): 111–121.

Goosey, H.B., 2009. A degree day model of sheep grazing influence on alfalfa weevil, *Hypera postica.* ProQuest Dissertation and Theses. Montana State Univ. Publication No. 3386528. pp: 78.

Gurrea, P., 1981. Ciclo biologico de *Hypera variabils* Herbst. (Col.: Curc.) en la Espana Central. Bol. Serv. Plagas. 7: 147–156.

Hamlin, J.C., Lieberman, F.W., Bunn, R.W., McDuffie, W.C., Newton, R.C., Jones, L.J., 1949. Field studies of the alfalfa weevil & its environment. United States Department of Agric. Tech. Bull. No. 975: 1–84.

Kanda, K., Morimoto, N., Shiba, T., 2004. Geographical distribution of alfalfa weevil (*Hypera postica* Gyll.) in the Kanto area, Japan in spring of 2003. J. Japanese Soc. Grassland Sci. 49 (6): 635–639.

Khanjani, M., Pourmirza, A.A., 2004. A comparison of various control methods of alfalfa weevil *Hypera postica* (Coleoptera: Curculionidae) in Hamadan. J. of Entomological Society of Iran. 24 (1): 67–81.

Kaufman, O., 1939. Der Lezerneblattnager (*Phytonomus variabilis* Hbst.). Teile I II, Zeitschrift Fur angewandtle Entomologie. 26 (2): 312–358.

Kushwaha, K.S., Jain, S.K., 1963. Studies on frequency of pest infestation in Udaipur II–on the frequency of Lucerne weevil, *Hypera variabilis* (Herbst.) (Coleoptera: Curculionidae) infesting Lucerne crop in Rajasthan Univ. Udaipur Res. Studies. 1: 84–86.

Lodos, N., Onder, F., Pehlivan, E., Atalay, R., 1978. The study of the Harmful insect Fauna of Marmara and Aegean Regions. Publications of Food, Agric. and Animal Husbandry Ministry of Republic of Turkey, Ankara, Turkey (In Turkish). 301.

Melamed–Madjar, V., 1962. Bionomics of alfalfa weevil (Hypera variabilis Hbst.) in Israel. Israel J. Agric. Res., 12: 29–38.

Metcalf, R.L., Luckman, W.H., 1994. Introduction to insect pest management. John Wiley and Sons, New York. 650.

Michelbacher, A.E., 1943. The present status of the alfalfa weevil in California. California Agric. Experiment Station Bulletin No. 677: 3–24.

Miller, C.D. F., Guppy, J.C., 1972. Notes on the biology of the alfalfa weevil, *Hypera postica* Gyll. (Col.: Curc.) In Southern Ontario. Proceedings of the Entomological Society of Ontario, 102:42–46.

Moradi–Vajargah, M., Golizadeh, Ali. Rafiee–Dastjerdi, Hoosang. Zalucki, M.P., Hassanpour, M., Naseri, B., 2011. Population density and spatial distribution pattern of *Hypera postica* (Coleoptera: Curculionidae) in Ardabil, Iran. Notulae Botanicae Hortic. Agrobotanici Cluj–Napoca. 39(2): 42–48.

Nayar, K.K., Anantha Krishanand, T.N., David, B.V., 1992. General and Applied Entomology, Tata McGraw Hill, New Delhi. 358.

Ohto, K., 1996. Effect of photoperiod on the adult diapauses in alfalfa weevil *Hypera postica* (Gyll.) Res. Bulletin of Plant Protection Service Japan. (32): 1–6.

Okumura, M., 1991. Biology & control of alfalfa weevil. Japan Agric. Tech. (8): 38–42 (In Japanese).

Pajni, H.R., 1981. Trophic relation & ecological status of adults of *Bruchus pisorum* L. and allied field species of Bruchidae attacking legumes (Pulses). (Ed. V. Labeyrie) Dr. W. Junk Publishers, The Hauge.

Pajni, H.R., Nanda, N., 1992. Some observations on the biology of *Acallopistus* species (Col.: Curc.) on *Abutilon indicum* .J. Bom. Nat. Hist. Soc. 89 (3): 388–389.

Pajni, H.R., Nanda, N., 1995. Bionomics of *Hypera postica* (Gyll.) (Coleoptera: Curculionidae) A pest of *Trifolium alexandrinum*. Hexapoda, 7(2): 85–92.

Pandey, K.C., Faruqui, S.A., 1990. Preferential response of Lucerne weevil to crude Extracts of some *Medicago* spp. Indian J. Ent. 52: 610–612.

Rather, B.A., Kumar, S., 2011. Analysis of factors responsible for outbreak of Alfalfa weevil (*Hypera postica* Gyll.) http://Krishisewa.com.

Salisbury, S.E., 2004. Alfalfa Insects: An overview of cutworms, Alfalfa weevil and Aphids. In–Proceedings Idaho Alfalfa and forage conference. 24–25 Feb. 2004.

Singh, J.B., Pandey, K.C., Saxena, P., 2009. Degree–day Model for development and incidence of Lucerne weevil Hypera postica (Gyll.) in Central India. Curr.t Sci. 96 (12): 1578–1580.

Subba Rao, B.R., Atma Ram, Singh, R.P., Srivastava, M.L., 1967. Further notes on Hypera postica (Gyll.) and its natural enemies. Indian J. Ent. 29 (4): 370–379.

Summers, C.G., 1998. Integrated pest management in forage alfalfa. Integrated Pest Management Rev. 3: 127–154.

Talwar, N., Pajni, H.R., 1995. Notes on the life history and habits of *Curculio c–album* (Fab.), (Col.:Curc.), a pest of *Eugenia* fruits. The Entomologist. 114 (2): 118–122.

Yakhontov, V., 1934. The alfalfa weevil (*Phytonomus varibilis* Hbst.) Proceedings Asia Institute of Cotton growing. Moscow & Tashkent. 238. (In Russian).

Tonguc, M., Erbas, S., 2012. Evaluation of fatty acid compositions and seed characters of common wild plant species of Turkey. Turk. J. Agric. 36: 673–679.