



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(5): 525-527
© 2021 TPI

www.thepharmajournal.com

Received: 24-02-2021

Accepted: 11-04-2021

SD Patil

Assistant Professor of
Entomology, Department of
Entomology, Zonal Agricultural
Research Station, Igatpuri,
Igatpuri, Nasik, Maharashtra,
India

DV Kusalkar

Associate Director of Research,
Zonal Agricultural Research
Station, Igatpuri, Igatpuri,
Nasik, Maharashtra, India

KD Bhoite

Asstt. Prof. Botany, Zonal
Agricultural Research Station,
Igatpuri, Igatpuri, Nasik,
Maharashtra, India

HM Patil

Associate Professor of
Agronomy, Zonal Agricultural
Research Station, Igatpuri,
Igatpuri, Nasik, Maharashtra,
India

SR Pardeshi

Asstt. Prof of Plant Pathology,
Zonal Agricultural Research
Station, Igatpuri, Igatpuri,
Nasik, Maharashtra, India

KM Sonawane

Senior Research Assistant, Zonal
Agricultural Research Station,
Igatpuri, Igatpuri, Nasik,
Maharashtra, India

Corresponding Author:

SD Patil

Assistant Professor of
Entomology, Department of
Entomology, Zonal Agricultural
Research Station, Igatpuri,
Igatpuri, Nasik, Maharashtra,
India

Studies on role of honey bees as a pollinators in increasing the yield of Niger (*Guzotia abbasynia*)

SD Patil, DV Kusalkar, KD Bhoite, HM Patil, SR Pardeshi and KM Sonawane

Abstract

Niger (*Guizotia abyssinica* Cass) is an important minor oilseed crop of hilly and tribal regions and it is used for oil as well as for various other purposes only by the tribal people. Therefore, a systematic study was arranged to ascertain the role and involvement of honey bees (*Aphis mellifera*) in increasing the seed yield of niger crop (due to pollination) and its effect on income due to increase in the niger seed yield. The experiment was conducted at Zonal Agriculture Research Station, Igatpuri Dist. Nashik, Maharashtra during *kharif*, 2020. Significant differences were observed for number of seeds/capitula, 1000 seed weight and seed yield. The treatment with natural plot uncovered/ open pollinated with one bee hive of *Apis mellifera* recorded significantly highest yield of 326 kg/ha, test weight 3.68 g and number of seed 17.20/ capitula as compared to treatment with net Covered plot with one bee hive of *Apis mellifera* which recorded the yield of 287 kg/ha, test weight 3.66 g and number of seed 11.60/ capitula. The treatment with control-net covered plot without bee hive (insect/ bee pollinator) recorded lowest yield of 92 kg/ha, test weight 3.24 g and number of seed 2.10/capitula. The gross monetary return (Rs. 48900/-) and net income (Rs. 27600) were found maximum in treatment with natural plot uncovered/ open pollinated with one bee hive of *Apis mellifera* and maximum benefit cost ratio of 2.83 was recorded in same treatment.

Keywords: Niger (*Guizotia abyssinica*), *Aphis mellifera*, pollination, honey bee, bee hive etc.

Introduction

Niger [*Guizotia abyssinica* (L.f.) Cass.] is commonly known as *ramtil*, *jagni* or *jatangi* (Hindi), *ramtal* (Gujrati), *karale* or *khurasani* (Marathi), *uhechellu* (Kannada), *payellu* (Tamil), *verrinuvvulu* (Telugu), *alashi* (Oriya), *sarguza* (Bengali), *ramtil* (Punjabi) and *sorguja* (Assamese) in different parts of the country. (Rao and Ranganatha, 1989) [15]. Niger although considered a minor oilseed crop, is important in terms of its 32 to 40% content of quality oil with 18 to 24% protein in the seed. Niger oil is slow drying, used in food, paint, soap, and as an illuminant. It is used as a substitute for olive oil, can be adulterated with rapeseed, sesame and linseed oil. The oil is used in cooking. The oil from the seed is used to treat burns and in the treatment of scabies. The seed is eaten fried and used as a condiment. The crop is capable of giving better seed yield even under low soil fertility, moisture stress and poor crop management. The states contributing primarily to the niger production of the country are Madhya Pradesh, Odisha, Maharashtra, Karnataka and Chhattisgarh. Besides, the crop is also cultivated to some extent in hilly areas of Andhra Pradesh, Bihar/Jharkhand, Gujarat, Uttar Pradesh, Rajasthan, Tamil Nadu, West Bengal, Assam and Arunachal Pradesh in North Eastern Hill region. In India total area under niger is 156.46 thousand hectares with production of 45.42 thousand million tonnes. (Anonymous, 2019) [11]. Major niger growing districts in Maharashtra are Thane, Ratnagiri, Raigad, Sindhudurg Kolhapur and Nashik.

The natural habitat is disturbed for many reasons and the vegetation cover is declining now a day's worldwide (Kearns *et al.*, 1998) [8]. Agriculture plays a role in declining native pollinators through the modification and elimination of pollinator habitats and the use of excess agricultural chemicals including pesticides, herbicides and fertilizers (Donaldson, 2002) [3]. Free (1993) [4] stated that clean and intensive cultivation of land may affect wild insect pollinators. He mentioned practices, such as destruction of hedgerows and rough verges, which destroyed many natural food sources and nesting sites of wild pollinating insects. Generally, it has been concluded that habitat degradation, pesticide misuse, diseases and intensive cultivation of lands may be the causes of decline in managed honeybees and wild pollinators (Gallai *et al.*, 2009) [5]. Niger although considered as a minor oilseed, is very important in terms of quality and taste of its oil and export potential (Rajpurohit, 2011) [12].

Honeybee pollinators are estimated to be involved in producing up to 30 % of the human food supply directly or indirectly; farmers rely on managed honeybees throughout the world to provide these services (Greenleaf and Kremen, 2006)^[6]. Honeybees are responsible for 70-80% of insect pollination (Johannsmeier and Mostert, 2001)^[7]. The contribution of managed honeybee pollination to crop production and quality has been estimated to be more than the value of honey and wax production (Shrestha, 2004)^[18]. Honeybees play an important role as a pollinator of the flowers of niger, which in turn cross-pollinates. Bambure (1958)^[2] found that flower heads of the species visited by honeybees had a higher average number of seeds when compared to flower heads without bee visitation. Panchabhavi and Rao (1978)^[9] reported that *Apis florea* serves as an important pollinator for this plant and sunflower under mixed crop conditions. Ramachandran and Menon (1979)^[13] found that the maximum amount of seed setting occurred in open pollinated plots. It also has been reported that bee pollination results in a 22-33% increase in niger yield (Panda *et al.* 1988)^[10] and that honeybees were the major pollinators (91.30%). It is known that the absence of pollination by insects adversely affects seed yields (Rao and Suryanarayana 1990)^[14]. Looking on significance in terms of oil extraction, which having high medicinal values, but knowledge of the diseases of this Niger crop merits attention, niger is a crop of dry areas grown mostly by tribal in interior places due to which desired attention has not been given. Now, the crop is gaining importance and studies are being made to ascertain there is tremendous contribution of honey bees (*Aphis mellifera*) and many other insects, flies and butterflies in increasing the seed yield of niger crop at the time of flowering (due to pollination) and its ultimately maximizes the income of farmers due to seed yield increase (Sandipan *et al.*, 2015a, b)^[16, 17]. Therefore, a study was planned to study the role of honeybees as a pollinator in increasing the seed yield of niger.

Materials and Methods

Field experiment was conducted in the experimental farm of Zonal Agriculture Research Station, Igatpuri Dist. Nashik, Maharashtra during *kharif*, 2020 in Randomized Block Design (RBD), having three treatments which were replicated seven times in plot size of 20 m x10 m. Seed was sown in the first week of July with 30x15cm spacing in *kharif*, 2020. All the agronomic practices were followed during crop growth period. The treatments were *viz.*, T1- Natural plot uncovered/ open pollinated with one bee hive of *Apis mellifera*, T-2 Control-net covered plot without bee hive (insect/ bee pollinator), T-3 Net Covered plot with one bee hive of *Apis mellifera*. At the time of flowering the experimental plot covered with net till the completion of flowering. At the time of harvesting the yield and test weight (wt. of 1000 seed), and average seed set (No. of seeds/ capitula) were recorded. Finally the per cent increase in grain yield was calculated and economics of the various treatments were worked out. Data recorded were subjected to statistical analysis.

Results and Discussion

The data regarding yield, test weight (wt. of 1000 seed), and

average seed set (No. of seeds/ capitula) is presented in Table 1. Significant differences were observed yield, test weight (wt. of 1000 seed), and average seed set (No. of seeds/ capitula). Data regarding the test weight (wt. of 1000 seed) presented in Table 1 showed non significant difference. The highest test weight (wt. of 1000 seed) of 3.68 g recorded in T1- Natural plot uncovered/ open pollinated with one bee hive of *Apis mellifera* whereas lowest of 3.24 g in T2- Control-net covered plot without bee hive (insect/ bee pollinator). Data presented in Table 1 illustrated that the treatment T1- Natural plot uncovered/ open pollinated with one bee hive of *Apis mellifera* recorded significantly highest yield of 326 kg/ha and number of seed 17.20/ capitula as compared to T3- Net Covered plot with one bee hive of *Apis mellifera*. which recorded the yield of 287 kg/ha and number of seed 11.60/ capitula. The treatment with T2- Control-net covered plot without bee hive (insect/ bee pollinator) recorded lowest yield of 92 kg/ha, test weight 3.24 g and number of seed 2.10/capitula. The treatment with T1- Natural plot uncovered/ open pollinated with one bee hive of *Apis mellifera* recorded highest of 254.35 per cent increasing yield over T2- Control-net covered plot without bee hive (insect/ bee pollinator). It is revealed that the honey bee has played major role in pollination of Niger as a pollinator and subsequent increase in yield of Niger. The data in respect of economics of different treatments are presented in Table 2. The gross monetary return (Rs. 48900/-) and net income (Rs. 27600) were maximum in treatment with T1- Natural plot uncovered/ open pollinated with one bee hive of *Apis mellifera*. It was followed by T-3 Net Covered plot with one bee hive of *Apis mellifera* (Rs.43050 and Rs.25780). The maximum benefit cost ratio was found in treatment with T1- Natural plot uncovered/ open pollinated with one bee hive of *Apis mellifera* (2.83) followed by T-3 Net Covered plot with one bee hive of *Apis mellifera* (2.02).

Significant differences were observed for number of capitula/plant, number of seeds/capitula, 1000 seed weight and seed yield (Prashant B. Sandipan *et al.*, 2017)^[11]. However, the seed yield and gross returns were considerably higher in Natural plot/ open pollinated with beehive (*Aphis mellifera*) these findings of this research are in corroboration with the result reported by Prashant B. Sandipan *et al.*, 2017^[11]. Similar line of results are reported by (Johannsmeier and Mostert, 2001)^[7], Panchabhavi and Rao (1978)^[9] and Ramachandran and Menon (1979)^[13] In present study the gross monetary return and net income were maximum in treatment with Natural plot uncovered/ open pollinated with one bee hive of *Apis mellifera* It indicated the contribution of honey bees (*Aphis mellifera*) and many other insects in increasing the seed yield of niger crop at the time of flowering (due to pollination). These results are in close conformity with those reported by Sandipan *et al.*, 2015a, b^[16, 17]. It is known that the absence of pollination by insects adversely affects seed yields (Rao and Suryanarayana 1990)^[14]. These results are in parallel results of present work as Control-net covered plot without bee hive (insect/ bee pollinator) recorded lowest yield of 92 kg/ha, test weight 3.24 g and number of seed 2.10/capitula.

Table 1: Role of honey bee in increasing the yield and test weight of Niger in relation to various treatments

T. N.	Treatments	No. of seed/ capitula	Test weight (g)	Yield (kg/ha)	% increase in yield over control
T1	Natural plot uncovered/ open pollinated with one bee hive of <i>Apis</i>	17.20	3.68	326	254.35

<i>mellifera</i>					
T2	Control-net covered plot without bee hive (insect/ bee pollinator)	2.10	3.24	92	--
T3	Net Covered plot with one bee hive of <i>Apis mellifera</i> .	11.60	3.66	287	211.96
SE \pm		0.41	0.31	8.81	
CD at 5%		1.22	NS	26.46	

Table 1: Economics of the various treatments

T. N.	Treatments	Yield (kg/ha)	Gross return (Rs)	Cost of cultivation (Rs)	Net income (Rs.)	B:C ratio
T1	Natural plot uncovered/ open pollinated with one bee hive of <i>Apis mellifera</i>	326	48900/-	17300/-	27600/-	2.83
T2	Control-net covered plot without bee hive (insect/ bee pollinator)	92	13800/-	19800/-	-6000/-	0.70
T3	Net Covered plot with one bee hive of <i>Apis mellifera</i> .	287	43050/-	21300/-	25750/-	2.02

Conclusion

It concluded that from the conducted experiment that the use of insect pollinators as honeybees (*Apis mellifera*) in niger crop is significantly helpful to increase the seed yield of niger crop in Natural plot with beehive (uncovered). As the honeybee pollinator increases the pollination activity by which the cultivator can increase their niger seed yield and income.

Acknowledgement

Author is extremely thankful to the Associate Director of Research, Zonal Agricultural Research Station, Igatpuri, Tal.-Igatpuri Dist. - Nasik (MS) and AICRP project on Niger for providing the required facility to conduct the experiment.

References

- Anonymous. SOPA.org/India-oilseed-area production and productivity 2018-19. Ministry of Agriculture, Government of India 2019.
- Bhambure CS. Effect of honeybee activity on Niger seeds production, Indian Bee J 1958;20:189-195.
- Donaldson JS. Pollination in agricultural landscapes, a South African perspective. In: *Kevin P. and Imperatriz Fonseca VL (Eds.) Pollinating Bees The Conservation Link between Agriculture and Nature*, Ministry of Environment, Brasilia 2002, 97-104.
- Free JB. Insect pollination of crops (2nd ed.). San Diego, CA: Academic Press 1993.
- Gallai N, Salles JM, Settele J, Vaissiere BE. Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecol. Econ.* 2009;68:810-821.
- Greenleaf SS, Kremen C. Wild bees enhance honeybees' pollination of hybrid sunflower. *Proc. Natl. Acad. Sci., USA* 2006;103(37):13890-13895.
- Johannsmeier MF, Mostert JN. Crop pollination. In: *Johannsmeier, M.F. (Ed.), Beekeeping in South Africa*, 3rd ed., revised, Plant Protection Research Institute handbook 14. Agricultural Research Council of South Africa, Pretoria, South Africa 2001, 235-245.
- Kearns CA, Inouye DW, Waser NM. Endangered mutualisms: the conservation of plant-pollinator interactions. *Annu. Rev. Ecol. Evol. System* 1998;28:83-112.
- Panchabhavi KS, Jai Rao K. Note on the effect of mixed cropping of Niger on the activities of insect pollinators and seed filling of sunflowers in Karnataka. *Indian J Agric. Sci* 1978;48(4):254-255.
- Panda P, Sontakke BK, Sarangi PK. Preliminary studies on the effect of honeybees (*Apis cerana indica* F.). Pollination on yield of sesamum and Niger. *Indian Bee J* 1988;50(3):63-64.
- Prashant Sandipan B, Jagtap PK, Patel MC, Solanki BP, Sapna Sharma R, Rathod N. Seed yield increase in Niger crop in to relation to Honeybee and other pollinators. *Cercetări Agronomice în Moldova* 2017;2(170):73-81.
- Rajpurohit TS. Diseases of Niger their management. *Plant. Sci. Feed* 2011;1(2):19-22.
- Ramachandran TK, Madhava Menon P. Pollination mechanism and inbreeding depression in Niger (*Guizotia abyssinica* Cass.), *Madrass Agric J* 1979;66(7):449-454.
- Rao GM, Suryanarayana MC. Studies on the foraging behaviour of honeybees and its effect on the seed yield in Niger. *Indian Bee J* 1990;52:32-33.
- Rao VLN, Ranganatha ARG. Niger in agriculture in Andhra Pradesh, Crops, SAA (Ed.), Hyderabad 1989;II:184-186.
- Sandipan Prashant B, Jagtap PK. Role of honeybees as pollinators in increasing the seed yield and income in the Niger (*Guizotia abyssinica* Cass) a tribal crop under South Gujarat region. *Trends in Biosciences* 2015a;8(6):1602-1605.
- Sandipan Prashant B, Jagtap PK. Honeybee - a natural pollinator in increasing the seed yield and income in the Niger (*Guizotia abyssinica* Cass) a traditional tribal crop of South Gujarat region. *Journal of Plant Development Sciences* 2015b;7(6):499-502.
- Shrestha JB. Honeybees and environment. *Agriculture and environment. Gender Equity and Environment Division. Ministry of Agriculture and Cooperatives, HMG, Nepal* 2004, 1-8.